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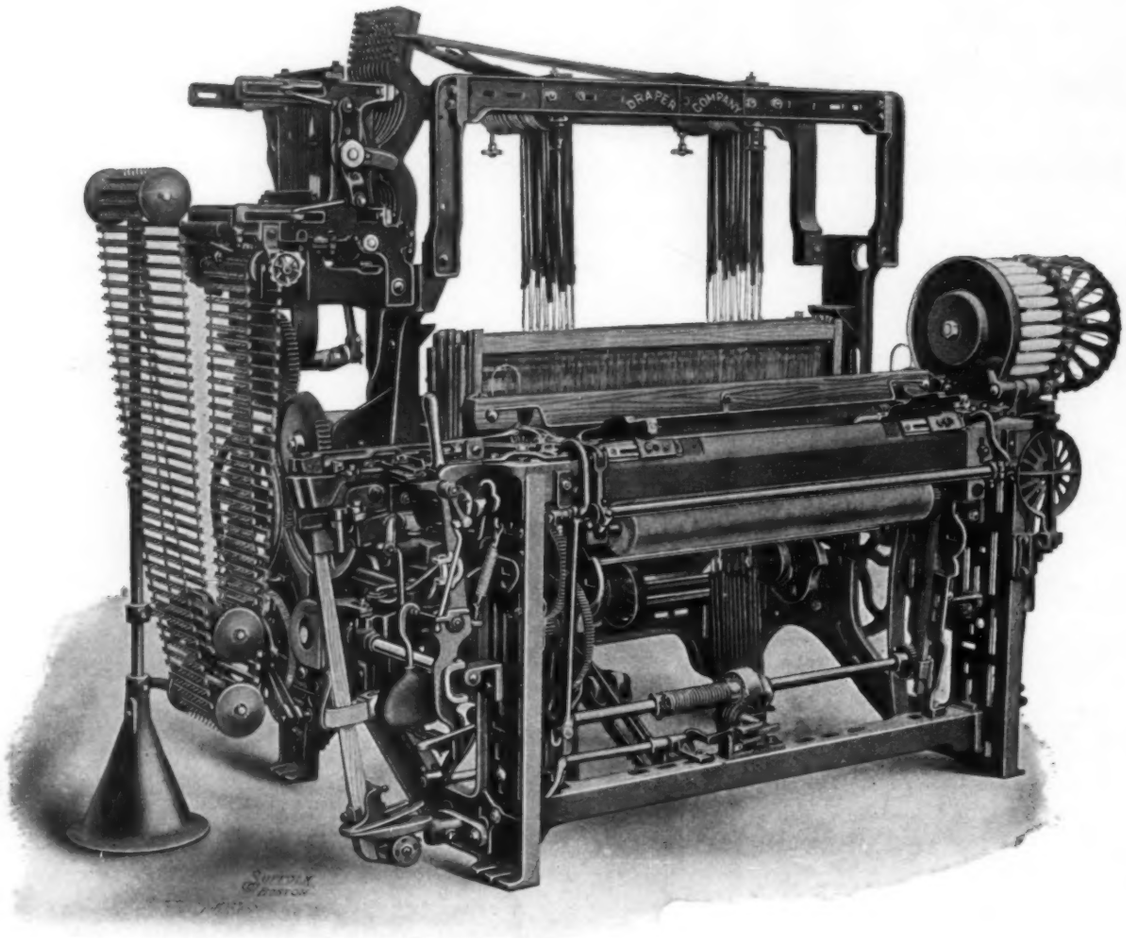

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THE FINE GOODS SITUATION.

The fine goods division of the cotton fabric market has shown a steady improvement for several months, and selling agents are frank to admit that the low point both as to prices and activity was more pronounced in the early spring months than during May, June and July when the medium fine and coarse counts entered into the eclipse of depression. In fact, this division is the most reliable barometer we have of the industry. Depression in the general industry is usually indicated by a halt in the fine goods division and, conversely, a recovery in the industry, as an economic unit, is manifested by increased activity in fine goods. That a recovery in the industry is approaching is firmly indicated by increased demand for fine goods, stronger prices and greater activity in the manufacturing end. There are several other strong indications pointing toward an immediate recovery, but the purpose of this editorial is to prove the influence of this particular branch of the great textile industry.

At a gathering of selling representatives of fine goods mills in New York City, the sentiment was freely expressed that the Western States had come in strong with orders for fine goods—both spot and future deliveries—during the last six weeks, and three gentlemen stated that their Western accounts had been larger in gross business and net profits during the month of June and to the middle of July than any previous six weeks for three years. These gentlemen have their fingers very close to the pulse of the consuming public, and when they are unanimous in the opinion that the market for fine goods in this country is broadening to such an extent that production should be increased 25 per cent. yearly to take care of the increased consumption it is well to accept such an opinion as a fact, without a reasonable doubt.

Fine yarns are being woven into fabrics that are finished into merchantable goods which are creating a market of their own without entering into competition with other fabrics; but the greatest expansion of this division will be in fabrics that will compete with silks. Recently in the treasurer's office of a large New Bedford fine goods mill a line of samples of goods to be placed on the market this fall, for next season's openings was seen, that will compete directly with silk and semi-silk goods. Experts who have seen this line declare that it will have the broadest market obtainable for a novelty, and after a season it will become a staple of great value to the industry. This mill has recently installed over 300 looms to be used for the production of orders for these goods.

Designers in the fine goods districts are working out new patterns that will develop this important branch of industry until the spindleage of fine goods mills in this country is doubled and trebled many times over. Fall River mills are already changing over to the fine and medium counts, and in many mill centers of the South there are

changes being made that will permit the manufacture of fine goods and mediums counts where coarse counts have always been made. No doubt the changing export conditions have an important influence, for are we not losing our Oriental trade on coarse goods?

Conditions in the manufacturing end are entirely favorable. While there is some little curtailment in New Bedford incidental to installing additional machinery and changing designs, patterns, etc., there is no concerted effort to curtail production and actual orders are being spun and woven. There is very little accumulation of fabrics or yarns as compared with the medium and coarse counts. In brief, manufacturing conditions are entirely satisfactory. The Taber Mill is installing 300 new Crompton & Knowles looms, while the Nashawenna has just ordered 1,400 Northrops. George H. Booth, of the Gosnold Mills has just announced to his friends that he proposes to build a 100,000 spindle mill this Fall and weave fine goods. And so one might name three or four other big mills that are to be built in New Bedford within a year, and to enumerate at least six mills that have placed orders for new machinery to replace old, and additional machinery for which new buildings will have to be erected.

In the opinion of many of the most prominent mill men in New England the greatest development in the cotton industry will occur in the fine goods division, and there are legitimate reasons for this. In the first place, social conditions demand greater production; then the cost of raw materials does not enter so largely into the cost of the finished products, so that violent price fluctuations of raw cotton will not be so disconcerting if the mills are on fine goods. The dividend record of New Bedford's fine goods mills can not be eclipsed by a group of manufacturing plants in any industry.

In short, the fine goods division of our great industry is recovering. With courage and patience manufacturers of medium and coarse counts will feel the stimulus, and complete recovery in the textile industry will become a condition. Then the spindles will whirl and the looms will hum their joyous tune of prosperity while the whole world will proclaim the textile, as the King of Industries.

COTTON MILL MERGER.

What is said to be the largest consolidation of cotton mills in this country, was recently consummated when the International Cotton Mills Corporation was organized in New York by mill owners, bankers, and capitalists from New York, New England and Baltimore. The new combine was incorporated on July 28th under the laws of the State of New York with a capital stock of $20,000,000. The concern will take over the controlling interest in the Consolidated Cotton Duck Co., Baltimore, Md.; Stark Mills, Manchester, N. H., Mount Vernon Mills, Baltimore, Md., and others, numbering in all twenty-two mills, located in the East and in Canada. Myron C. Taylor of the Consolidated Cotton Duck Co., is president of the new International Cotton Mills Corporation, and the following statement concerning the consolidation of the cotton mills was given out by President Taylor:

"The International Cotton Mills Corporation was incorporated under the laws of New York, with an authorized capital of $20,000,000, divided into $10,000,000 seven per cent. cumulative preferred stock, and $10,000,000 common stock. The company will acquire, either by direct ownership or by stock control, certain textile mills, sales and distributing companies, located in this country and in Canada, which, together manufacture and sell some 3,000 varieties of cotton fabrics, probably a greater diversity of cotton fabrics than any other concern.

"A number of prominent New England, New York and Baltimore mill men are identified with the new company and will control its management.

"The following were elected directors of the company August P. Loring, Boston, president of the Plymouth Cordage Co.; Rodman P. Snelling, Boston, treasurer of the Saco-Pettee Co.; Edward Lovering, Boston, treasurer of the Massachusetts Mills; Frank J. Hale, Boston, manager of the Saco-Pettee Co.; J. D. Armitage, Boston, former manager of the Arlington Mills; P. T. Jackson, Jr., Boston, president of the Boston Yarn Co.; Albert L. Scott, Boston, treasurer of Lockwood, Green & Co.; F. A. Carpenter, Manchester, N. H., banker; Charles M. Warner, New York, president of the Warner Sugar Refining Co.; E. A. Brinckerhoff, New York, vice-president of the Merchants' National Bank; Thomas M. Turner, New York, president of the J. Spencer Turner Co.; Myron C. Taylor, New York, president of the International Cotton Mills Corporation; S. Davies Warfield, Baltimore, president of the Continental Trust Co.; David H. Carroll, Baltimore, president of the National City Bank; J. H. Wheelwright, Baltimore, vice-president of the Consolidation Coal Co., and William H. Grafflin, of Baltimore.

"The following were elected officers of the company: Myron C. Taylor, president; Charles M. Warner, Thomas M. Turner and P. T. Jackson, Jr., vice-presidents; J. D. Armitage, general manager; Augustus P. Loring, treasurer; David H. Carroll, secretary; S. Davies Warfield, chairman of the board of directors.

"A controlling interest in the preferred and common stocks of the Consolidated Cotton Duck Co. will be acquired," the statement continues, and "through the control of the Consolidated Duck Co., the Bay State and other properties, there is brought under one management properties which have not been in competition, but which have manufactured different varieties of cotton goods. Therefore, the new company is enabled to present to the trade probably a greater diversity of fabrics made from cotton than any other textile organization.

"Properties represented number 22 mills and include some 35 principal brands, many of which have been in the world's markets for more than half a century. The long-established character of the business is indicated by the fact that one of the selling companies has this year celebrated the 100th anniversary of the founding of its business.

"The International Cotton Mills Corporation carries out a plan which has been carefully worked out during the last six months, with a view of concentrating large non-competitive cotton interests, manufacturing a great variety of cotton products. The products of these mills reach the markets of the world; it is therefore recognized that the extension of the business and its more effective management can be better accomplished by union of forces."

Trade Wastes and Stream Pollution.

(Contributed Exclusively to COTTON.)

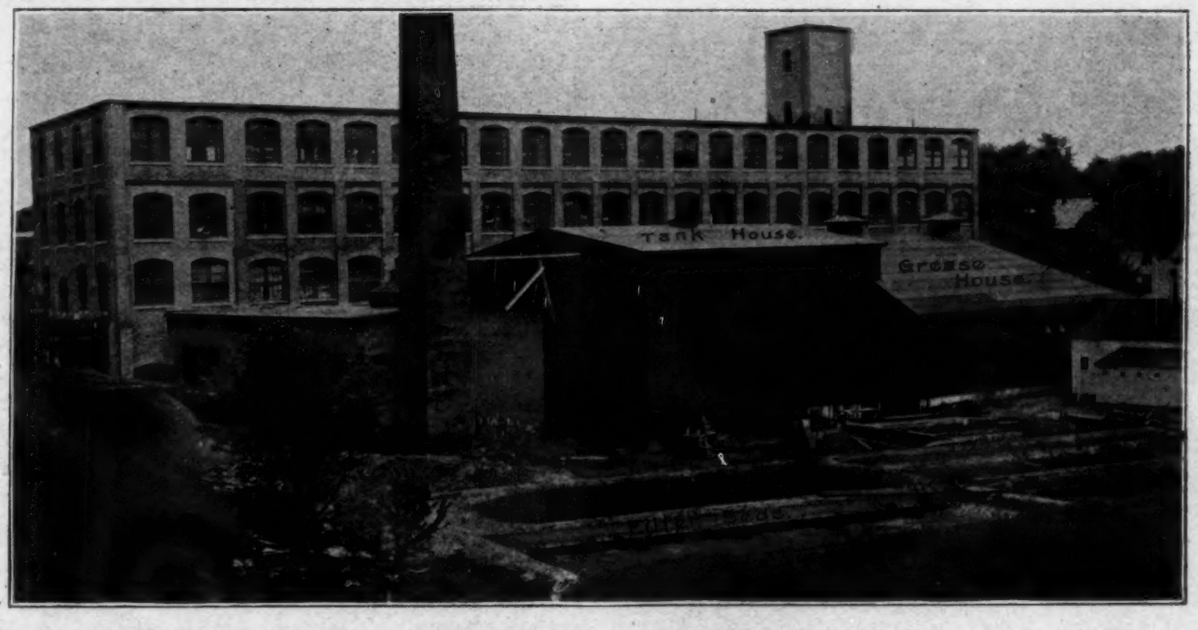
BY ROBERT SPURR WESTON, CONSULTING SANITARY ENGINEER.

CONDITIONS CONFRONTING THE EAST—CHARACTERISTICS OF TRADE WASTES—GENERAL METHODS OF TREATMENT—DESCRIPTION OF A GREASE RECOVERY PLANT.

No public spirited American manufacturer desires to create a nuisance by the discharge of factory wastes into a stream, yet many practices of this kind, once inoffensive, are now causing serious anxiety on the part of those concerned with the maintenance of the purity of inland waters. Fifty years ago the amounts of contamination were not great enough, in but few cases, to exceed the natural capacities of the streams for self-purification. The wastes from the tannery, bleachery, dye house, cloth washer and scouring bowl were discharged without serious offence. Since then, not only has the population increased enormously but in the East at least it has changed from one characteristically rural to one essentially urban.

Unfortunately the geological conditions which make certain streams attractive, useful for the water supply of towns and their banks excellent locations for cities and towns, also make them suitable for the manufacture of all articles requiring soft clear water. On the other hand it must not be forgotten that especially in New England prosperity depends on manufactures, and where the factories are, there the people will be gathered together. The aim, therefore, should not be to preserve the water of all streams in its natural purity nor to park the shores of all brooks and lakes, but to so use the streams that manufacturer, municipality, and individual will have the fullest use of the water therein consistent with the rights of all.

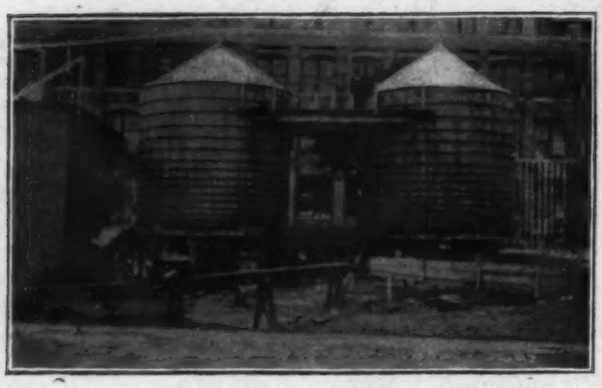
It is increasingly impracticable to maintain drinking water conditions in most streams, and no modern sanitary engineer recommends surface water for water supply, which is not first purified by filtration, storage or other adequate agency. It follows, therefore, that two opposite uses may be made of a stream, dependent upon local conditions—if the stream be used for water supply the degree of purification of all discharges into it must be higher than if it be devoted to manufacturing alone. In the first case the purification of the manufacturing waste and especially the domestic sewage discharged into it must be at least complete enough not to overtax ordinary means of water purification. In the second case the requirements may be met by a degree of purification which will prevent putrefaction of the water, the soiling of the banks and bottom with floating and suspended matter, and in general preserve the appearance of the water and its fitness for industrial and general uses by the inhabitants of its banks.



GENERAL VIEW OF THE HUDSON WORSTED COMPANY'S WOOL SCOURING WASTE DISPOSAL PLANT, SHOWING THE TANK HOUSE, GREASE HOUSE, SETTLING TANK FOR TREATED WASTE, AND FILTER BEDS.

The growth of manufacturing has exceeded that of population. Not only have the volumes of waste from factories increased, but there have been great increases in the amounts of domestic sewage from the rapidly growing cities and towns. All these factors singly or combined have caused many streams to be overtaxed. The conditions in the Passaic, the Blackstone, the Neponset, the Youghiogheny, and some other rivers have demanded a remedy for some time. Recently the Massachusetts State Board of Health has been given additional authority to prevent the contamination of streams. In Pennsylvania the State Department of Health has taken vigorous steps toward the same end, and in other States similar legislation has been or is being enacted. It is evident that something must be done to preserve the appearance of the many naturally beautiful rivers and ponds.

The most serious contaminating substances in streams are the suspended matter and fat which are present in the



Chemical Treatment Tanks of Hudson Worsted Co.

wastes of many different industries. It is remarkable how rapidly the liquid portions of trade wastes are purified when discharged under ordinary conditions into flowing rivers. But this is not so with the suspended solid portions. These resist, often for months and years, the purifying action of the stream. Who has not noticed deposits of hair, fat, soap, skin or malodorous mud in mill ponds or decomposing refuse in streams or harbors?

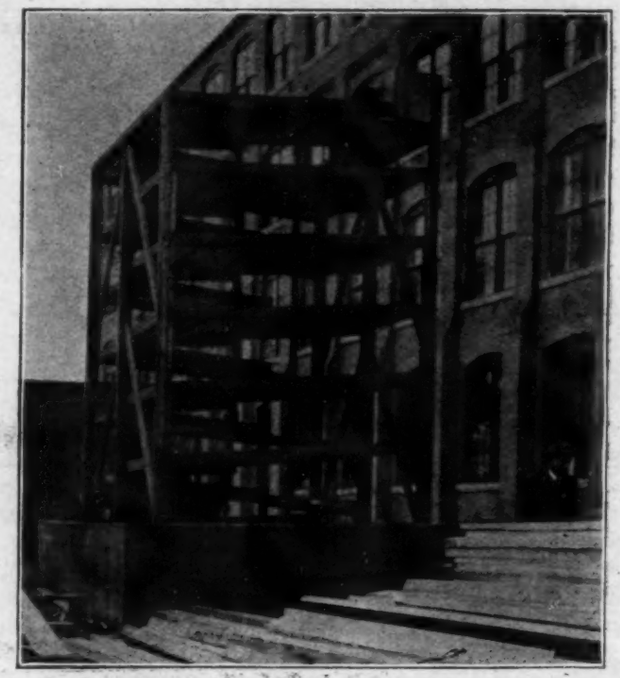
The old idea that a stream will purify itself after seven miles of flow is largely true for the dissolved portions of contaminating waste, but the later statement that no English river is long enough to completely purify itself is true indeed when the stream contains considerable amounts of contaminating suspended matter. Therefore, the problem of trade waste disposal, far more than that of domestic sewage disposal, resolves itself into the problem of the disposal of the suspended matter, which, of course, includes the fat. In order to understand how great a contribution of suspended matter is made by certain trade wastes some descriptions and figures are necessary.

CHARACTERISTICS OF TRADE WASTES.

Even in England where most of the work has been done, the practical disposal of trade wastes has been conducted on a rule-o'-thumb basis, and very few data are available. Still, there are the following few figures, which have been compiled from the Water Supply and Irrigation papers of the United States Geological Survey and from the laboratory records of the writer. They show the chief characteristics of several trade wastes:

Kind of Waste	Parts by Weight Per Million			Remarks
	Total Solids	Suspended Matter	Fats	
Domestic sewage	803	300	50	Typical Boston sewage, Winslow and Phelps.
Wool scouring waste	28,000	17,000	15,000	Mass. Plant.
Wool scouring waste	75,000	----------	36,000	Avg 4 R. I. plants.
Cloth dyeing waste	790	0	14	Minimum.
Cloth dyeing waste	4,430	90	430	Maximum.
Cloth washing waste	4,740	----------	2,140	
Cloth washing waste	2,148	568	600	First wash water.
Cloth washing waste	584	138	110	Final wash water.
Spent bleach liquor	18,000	----------	3,500	
Spent bleach liquor	18,000	----------	1,000	Caustic soda boil.
Rinsing water	850	----------	100	
Sulphite liquor	84,530	----------	----------	
Straw-board waste	----------	28,000	----------	

It will be seen that these various trade wastes contain up to nearly 30,000 parts by weight of suspended matter per million, and up to about 35,000 parts by weight of fat, that is, 3 per cent. of suspended matter and 3½ per cent. of fat, or 125 tons of suspended matter and nearly



Cooling Tower of Hudson Worsted Co.

150 tons of fat per million gallons of waste. There are several large mills in this country which are discharging between 5 and 10 million gallons of waste daily, and many whose waste amounts to from 10,000 to 100,000 gallons daily. Compared with the matter discharged with domestic sewage these quantities are enormous, as will be understood when one considers that it is rare for domestic sewage to contain over 1½ tons of suspended matter or ¼ of a ton of fat per million gallons. Under ordinary conditions the trade waste is usually several times as strong as sewage and is more apt to contain high amounts of fat and other materials which interfere with the operation of ordinary sewage disposal plants.

It is desirable and often necessary, therefore, that the manufacturing waste problem be treated separately from the sewage disposal problem, and owing to the great variation in the character of manufacturing wastes themselves each individual problem requires a different solution. For example, one case in the writer's practice required the removal of all of the fat from wool scouring waste by chemical treatment, subsidence and filtration, while another required only the passage of the waste from the manufacture of low-grade, cotton-warp woolens through a simple settling tank.

GENERAL METHODS OF TREATMENT.

Generally speaking the methods of treatment may be grouped under the following headings:

1. Plain subsidence.
2. Subsidence with the aid of chemicals, with or without the recovery of by-products from the precipitated sludge.
3. Straining.
4. Filtration.

Any one or all of the above may be used in combination. In certain cases it is best to treat one of the several wastes from a mill by one process and then mix the waste so treated with the remainder for treatment by a subsequent process. For example, in a tannery where wool is washed it is often wise to recover the fat from the wool washings

by treatment with sulphuric acid and to mix the acid effluent with the alkaline tannery waste for subsequent treatment either by plain subsidence or by plain subsidence combined with filtration. Again, the alkaline waste from an old-fashioned tannery discharging into a municipal sewer needs only to be treated by plain subsidence to remove the suspended matter. Likewise the waste from certain paper industries can be sufficiently purified, and the fiber recovered from the subsiding basin may more than pay for the cost of treatment.

SUBSIDENCE. Nearly all trade wastes contain large percentages of matter which can be removed by plain subsidence. For this purpose there is nothing so efficient as a properly designed subsiding tank. Formerly these tanks were designed on the intermittent or fill-and-draw principle, but now it is customary to build a much smaller and more efficient tank to work on the continuous plan, which not only removes from 30 to 99 per cent. of the suspended matter, but also permits the removal of the sludge from the bottom of the tank without disturbing the operation thereof. This possibility has been brought about by special arrangement of the bottom, by scientific baffling of the flow and by careful attention to the size and depth required.

Where waste is discharged into a sewer, the discharge from which is purified subsequently by a municipal sewage disposal system, this method is almost always adequate. It will not, however, remove fats from wool waste or soap (soap is a combination of fat and alkali) from tannery, wool scouring, and cloth washing and bleaching wastes. Consequently treatment with chemicals or special treatment must be used.

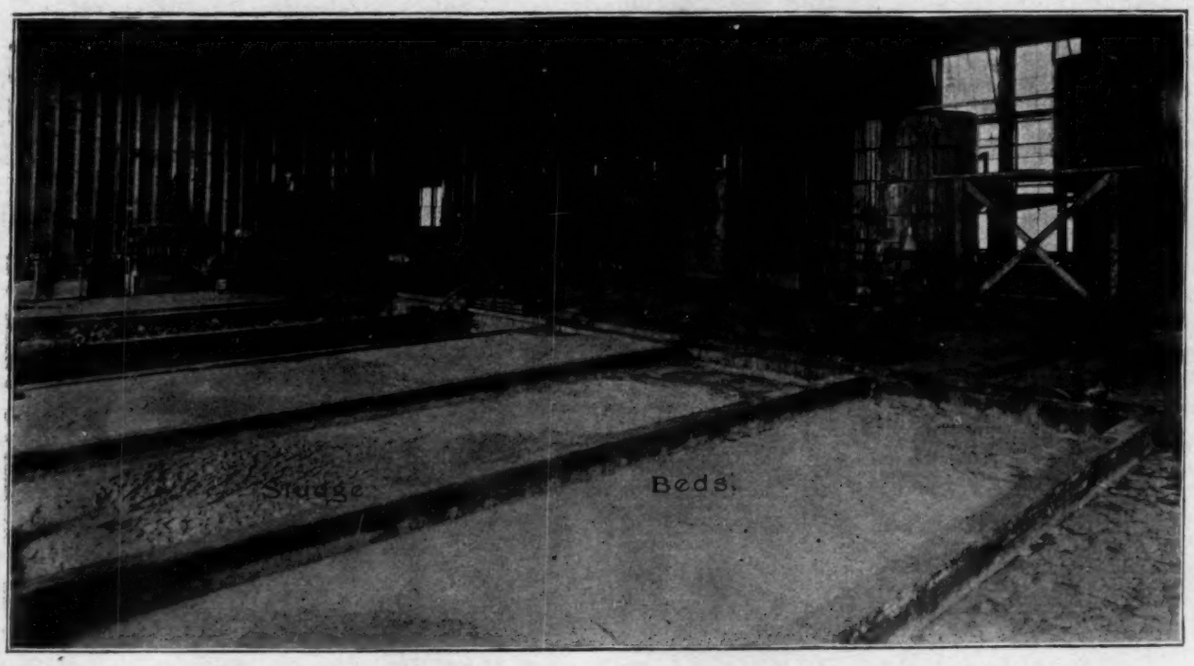
SUBSIDENCE WITH CHEMICALS. For the removal of fat, for the decomposition of soap, and for the precipitation of the fat, sulphuric acid is most frequently used, and for this process many plants abroad and a few in this country have been built. This process has the advantage of simplicity, but the fat so recovered is acid and not so valuable as when recovered by some other method—this will be explained further on.

The most recent method—unfortunately not in use in this country as yet—is one where the soapy wastes are first evaporated to a syrupy consistency. The fat and watery waste are then separated by a centrifugal machine not unlike a cream separator; the pure fat is readily recovered from the "cream" outlet, while the "skim milk" is evaporated in order to recover the potash or other valuable salts contained therein. This process requires a larger investment than does the acid process but the profits (59 per cent. in one case) are considerable on account of the better quality of the grease and the value of the recovered alkali. All of the waste being evaporated, there is little left to be disposed of by filtration or otherwise.

Many wastes, such as the "grey boil" liquor from bleacheries and wastes from some of the hide and leather industries, may require precipitation with lime and copperas, sulphate of alumina, or lime alone in order to effect the economical removal of the suspended matter. Such processes are rarely profitable, and the precipitated sludge is of little or no value. They are often necessary, however, where a bleachery or a large mill discharges its waste into a small stream.

STRAINING. Wastes discharged from subsiding tanks are often passed through sand or cinder beds or filter presses to remove the remaining suspended matter or fat. Such strainers exert only a mechanical removal of the suspended matter. They are not true filters. Yet for many wastes like straw-board waste or those containing spent bleach or other disinfectants, they are the only practicable means of final purification. It is usually not economical to strain any waste without preliminary subsidence.

FILTRATION. Many wastes like those from abattoirs, creameries, and tanneries, containing large amounts of oxidizable organic matter which would putrify if discharged into a small stream, require filtration as a final process. By filtration is meant not straining alone but the oxidation of the organic matter contained in the waste by the bacteria growing on the surfaces of the particles composing the filling of the filter and by the oxygen from the air.



VIEW OF INSIDE OF GREASE HOUSE, SHOWING HYDRAULIC PRESSES, FILTER PRESS, GREASE STORAGE TANKS AND SLUDGE BEDS OF HUDSON WORSTED CO.

Two general types of filters are in use, namely, intermittent sand filters where the beds are dosed and rested alternately, and trickling filters where the waste is applied in the form of a spray, the object in both cases being to admit a supply of air for the support of the bacterial oxidation process. The exuents from such filters where no disinfectant prevents the growth of bacteria, are usually excellent. Sometimes it is necessary to mix domestic sewage with trade waste in order to maintain a good growth of bacteria in filter beds, because many wastes have been boiled and are practically free from bacteria. In other words, when the wastes contain few bacteria they have often to be seeded with the bacteria of sewage before filtration.

The sizes of filters and kinds of filter material are governed by local conditions. Frequently screened cinders from the boilers can be used to advantage. In the trickling filter the material has to be coarser than in the intermittent filter, where medium sand is generally used.

In the above description of methods no mention has been made of evaporation, except for the recovery of fat from wool scouring waste by the so-called Smith-Leach method. This latter process, on account of the great economies possible, has been very successful in England. Evaporation is also used for the treatment of the waste from glue factories, fertilizer works and other industries where the wastes contain exceedingly large percentages of organic matter, too large to be treated by any of the processes described above. Many mills wash wool in some solvent like naptha and recover the fat in this way, while in France the wool scouring suds are beaten to a froth which is skimmed off and the fat recovered therefrom. Neither of these processes, however, is generally applicable, the first because of its elaborateness; the second for economic reasons.

EXPERIENCE IN PRACTICE.

The West Riding district of Yorkshire, England, may be cited as an example of extreme conditions. Here exist large communities engaged in manufacturing and relatively small flows in the streams. At the same time it is an example of how to preserve the appearance of the streams without hampering the growth of industry.

The West Riding district comprises an area of about 2,750 square miles and a population in 1905 of 2,750,000 including the cities of Sheffield (450,000), Leeds (440,000), Bradford (300,000), Halifax (105,000), and Huddersfield (95,000). In 1905 there were in this district 2,005 factories discharging trade waste, as follows:

KIND OF INDUSTRY.	NO. OF FACTORIES.
Coal works	59
Leather works	143
Breweries and malt houses	247
Paper factories	26
Textile mills	960
Bleacheries	16
Iron and metal works	98
Chemical, gas, and soap works	160
Stone and marble works	50
Miscellaneous	246
Total	2,005

Of these 2,005 factories, 941 discharged their waste directly into the various streams of the district, while 1,064 were connected with the city sewers and the wastes were disposed of in connection with the town sewage. Of the 941 factories discharging wastes directly into the streams, over 60 per cent. (651) were provided with purification plants, leaving only 290 from which wastes were discharged directly into the streams without purification. In other words, less than 15 per cent. of the industries in this district discharged trade wastes directly into the streams without purification.

The conditions in the United States and Canada are in great contrast to those prevailing in England. In the first place the same necessity for purification of trade wastes has not existed except on a few streams, and on these the degree of contamination has been allowed to exceed greater limits than abroad. The writer does not believe, based on the result of his observation, that in the whole United States there are more than 40, certainly not more than 60, disposal plants treating waste before its discharge into stream or sewer, and there are less than 15 plants where any attempt is being made to recover fat or other valuable by-products. The common practice is to discharge into a stream or to connect with the municipal sewer and place the burden of purification upon the public.

In Peabody, Mass., where numerous tanneries discharged directly into the sewer when first built, and in several other places, serious clogging of the sewer and great outlay for cleaning have been caused. Therefore, in such cases, it is not at all unlikely that the cheapest plan for all concerned—namely, that the municipal sewage disposal works should not attempt to dispose of more waste in connection with its domestic sewage than it can do economically, and the manufacturer should give any troublesome waste sufficient preliminary treatment to bring about this result—will be forced into use in densely populated industrial centers in America as it has been in England, even if the city has to bear a portion of the expense of treatment at the factories.

Where a waste contains fat the cost of this preliminary treatment without the recovery of the fat is often prohibitive, and where possible plants are designed with this end in view. As an illustration, the grease recovery plant designed by the writer for the Hudson Worsted Co., (Hudson, Mass.,) may be described briefly. The accompanying illustrations give one a good idea of the general arrangement. At this mill 150,000 pounds of wool are washed weekly, and when running full from 15,000 to 30,000 gallons of waste are discharged daily.

This waste, which is first passed through settling basins to remove the coarser suspended matter and pumped over a cooling tower to reduce the temperature, is pumped into one of three treating or "cracking" tanks, where it is treated with sulphuric acid and thoroughly stirred with compressed air. Ordinarily the fat and other suspended matter subside slowly in the form of sludge. The clear liquor is then passed through the settling tank where more of the fatty sludge settles out and then on to beds of sand or cinders, from which the waste emerges sufficiently well purified to be discharged into the stream or sewer.

The sludge is run from the bottoms of the treating tanks on to thin sand beds, where it is allowed to dry. Portions of the partly dried sludge are wrapped in burlap and placed in a steam jacketed hydraulic press, where under the action of live steam and hydraulic pressure a large portion of the fat is extracted. The mixture of grease and water running

from the press is pumped into a decanting tank from which the grease overflows into storage tanks and the greasy water runs off to be treated again with the raw waste. The grease is refined and run into barrels while hot.

The recovery of grease in this way at prices less than two cents a pound ordinarily cannot be carried on at a profit. Above two cents there should be some return on the investment, dependent upon the size of the plant and other local conditions. The dried press cake contains considerable fat and has good value as a fertilizer. The effluent contains less than 200 parts of fat and less than 200 parts of suspended matter by weight per million. Although it is quite acid, yet it can be discharged into stream or sewer with impunity.

The writer hopes that in this rather incomplete outline he has made clear the fact that no general method can be devised for all cases, and each problem must be handled separately with due regard both to the conditions obtaining at the factory and also to the quantity and character of the body of water into which it is proposed to discharge the purified waste, but that nearly all are capable of solution provided they be approached with intelligence.

MOTOR TRUCKS IN MILL YARDS.

In northern New England where cotton mills have an abundance of their own water power with surplus energy that can be used to operate a small generator, manufacturers have found it advantageous to use electric trucks for mill yard transportation.

At Manchester, N. H., the Amoskeag Mills use electric trucks, and at Biddeford, Me., the Pepperell Mills also use electric trucks because they have sufficient surplus power from their own plants to charge their storage batteries at no expense.

However, there is another side to the question of power for automobile trucks. In cities, like Fall River and New Bedford, and the majority of Southern mill districts where the mills do not own water power and where it would be necessary to run an engine all night to recharge a storage battery the gasoline power trucks are far more satisfactory.

Steam cars are used very largely in England for mill yard transportation; but in this country the four cycle gasoline power truck has became a very important factor in transportation. Gasoline has no limit for mileage, providing the fuel tanks are kept filled, which is a big advantage in textile mill yard transportation where long hauls are made and continuous traffic is necessary. The gasoline car has an advantage over the steam in many respects. A steam truck has an exposed flame which is more hazardous than a gasoline engine, but which is not in violation of the terms of insurance policies covering cotton mill property.

At Killingly, Conn., the Attawaugan Mills purchased a gasoline truck last fall to use in hauling coal and cotton from the railroad station at Dayville to Attawaugan and Ballouville, being from two to four mills distance and up quite a grade. The truck was tested through the fall and winter and given very severe use. Inexperienced operators encountered snow-drifts four feet high and ploughed through mud and dust four inches deep, until this spring, when the car was returned to the manufacturer and thoroughly overhauled. Aside from a few worn parts, resulting from insufficient lubrication, the car was in excellent condition and was returned to the company one month later as good as new. Since then the company has purchased another truck and has now displaced 12 horses and 5 men.

The above case is a typical illustration of the success of the motor truck in hard places. This company has to haul every pound of cotton and other materials used in its three mills, from two to four miles and operates 40,000 spindles and 1,000 looms.

In cotton mill yard transportation it has been figured that the limit for profitable horse haulage a day is eleven miles for a two-ton truck, and nine miles for a five-ton truck. A gasoline motor truck will travel 50 miles or more per day, and will be ready to repeat the operation without a resting period, if called upon to do so. It has been actually proven by experiments that one motor truck will displace four to five teams, and two trucks will do the work of 10 to 14 horses in one-half the time and with one-half the number of men required to drive the horses.

One of the deterents to the use of the motor truck in mill yards in the past has been the difficulty and expense of obtaining drivers of sufficient intelligence to care for the motors. The simplification of the modern gasoline motor has largely done away with this objection, while the more general use of the motor vehicles has added largely to the mechanical knowledge of young men seeking employment at the present time. The construction of the best types of gasoline motor vehicles is now so simple that any driver of ordinary intelligence can operate a motor truck with safety and dexterity after a very few lessons.

The operating expense of a motor truck is very low. Gasoline can be purchased from Maine to Florida at from 11 to 14 cents a gallon, and the average mileage for a loaded motor truck is five to twelve miles with a gallon of gasoline. Lubricating oil can be purchased at around 25 cents a gallon, and a truck should run 100 miles with a gallon of oil. For five years the writer paid 60 cents a gallon in barrel lots for lubricating oil for use in cylinders and transmission. We are now buying a high grade oil for the same purposes at 30 cents per barrel. There are plenty of excellent oils on the market at 25 cents a gallon, although many users of trucks prefer to pay fancy prices because attractive advertising literature accompanies each invoice.

In considering the question of tires, there are many arguments in favor of the solid and the pneumatic. Solid tires can be operated for greater mileage with no expense for punctures, while pneumatic tires carry the load easier and with less jar and vibration on the truck and engine. Where pneumatic tires are used there is less motor trouble and less jarring when the truck is being loaded with freight. Furthermore, jars on the road are eliminated, and the load is handled easier in slippery places and in winter months. On the other hand the solid tire will go over 500 miles further than the air tire and will wear more evenly. If the pneumatic tire is punctured it means a great effort to jack up the wheel and repair the inner tube while a serious delay occurs. Many trucks are equipped with two wheels which, it is claimed, increases the life of each tire to 9,000 miles of just double the guaranteed mileage when one wheel is used.

The question of tires should be frankly considered when buying the car and the judgment of the manufacturer should

be accepted after he has been told conditions under which the car is to operate. In very sandy soil the pneumatic tire should be used, while in poor roads and stony places the solid tire should be given preference.

The motor truck for cotton mill use is a factor of unquestioned merit, and it should be a live issue with every progressive manufacturer of cotton goods. The costs of transportation in the mill yard can be greatly reduced, and greater efficiency result from the use of motor trucks; and the time is not far distant when horse drawn vehicles will be displaced by motor trucks for commercial and industrial transportation.

LOWELL TEXTILE ASSOCIATION ORGANIZED.

A new textile association was permanently organized in Lowell, Mass., on June 30th, and is known as the Lowell Textile Association, the object of which is to promote a greater social intercourse among its members, to encourage indoor and outdoor sports and pastimes, and to maintain quarters for literary and social purposes. At the meeting where about 125 members had gathered, the following board of directors was elected for the ensuing year:

E. D. Robinson, overseer Shaw Stocking Co.; C. H. Howard, assistant paymaster Hamilton Manufacturing Co.; E. L. Kirby, paymaster Boott Mills; H. A. Wisbey, overseer Merrimack Manufacturing Co.; A. M. Chadwick, assistant agent Tremont & Suffolk Mills; Jno. B. Rule, assistant superintendent Lawrence Manufacturing Co.; A. E. Gregory, clerk Massachusetts Cotton Mills; Jesse Whitworth overseer Lowell Bleachery, and W. M. Sherwell, paymaster Appleton Company.

The board of directors met in the first week in July and elected the following officers:

President, E. D. Robinson.

Vice-President, A. M. Chadwick.

Treasurer, C. H. Howard.

Acting Secretary, W. M. Sherwell.

A permanent secretary will be elected at a later date.

Much interest is being manifested in the new association and it is expected that by the time the club rooms are secured, the membership will show at least 150 members. An outing will be given on Saturday, August 6th, with the idea of creating more interest in the association. It is proposed to fit up attractive club rooms in a central location in Lowell, to be open to members at all times, and to be equipped with billard, pool, and card tables, also a reading room where magazines and textile papers will be available; to have talks from time to time on interesting subjects, either textile or general, by well known men.

The eligibility requirements for active membership are, that a man must be of good character, twenty-one years of age or more, and one who is an official, overseer, or clerk of any textile corporation or textile machinery manufacturing company in Lowell or towns next adjoining. The cost of membership will be $10.00 to be paid by October 1st, 1910, which will cover all expenses of dues to July 1st, 1911. After that the yearly dues will not exceed $10.00 payable quarterly, or $8.00 if paid in advance in July for the entire year. An entrance fee of $5.00 in addition to the yearly dues will have to be paid by others than the charter members.

AMERICAN COTTON GOODS IN CHINA.

THE DAWN OF A NEW ERA IN THE EMPIRE—A TREMENDOUS OPPORTUNITY FOR SOUTHERN COTTON MILLS.

(*Contributed exclusively to* COTTON.)

BY G. WINFRED PEARCE.

Special interviews held with the principal operators of the cotton mills which for a number of years have been credited with the most of the exports of our country's cotton goods to China, exhibit that the prospects for that trade with China will be largely increased as the railways in process of construction in China come to completion. Within a twelvemonth, the new steam railway mileage in China will be 5,000 miles of well built single track lines with ample sidings.

The density of the population in the most sparsely settled Province in which these lines are being built is just about that of the Borough of Manhattan. These Chinese railways are designed to supplement waterways which are navigable for light draught steamboats, lines of which are to be operated by the Imperial Government in connection with the postal and express freight services. In recent construction of Imperial telegraph lines, much has been accomplished in the most populous Provinces of China, so that of late, for the first time, considerable business with relation to American cotton and cotton fabrics has been transacted by telegraphic communications between the interior and the coast and river ports.

Accepted plans by the Imperial Board of Posts and Communications in China call for the construction of 25,000 miles of railway within five years. Chinese capital will build these lines. Organized and enlightened public opinion expressed through native newspapers did not exist in China until recently. Today there are 250 native Chinese newspapers in China, most of which are under the control or patronage of public spirited Imperial officials under whom the ancient classical learning in all schools was abolished in 1905, and western learning made obligatory throughout the Empire. Since that time almost 9,000,000 Chinamen and nearly 1,000,000 Chinawomen have had at least four years of education in sound learning of the Occident, for service to practically minded persons desiring to get on in industrial pursuits.

The Chinese are intensely matter of fact and practical. The commercial, manufacturing, transportation and banking and brokerage methods of the most enlightened Western nations appeal to them all much more than does anything savoring of poetry, rhetoric or literature that is of no value as to material matters. All the native newspapers of China are edited by men who have been in America or Europe for long periods, or who were educated by European and American teachers in Chinese schools. Matters relative to American and European commerce and manufactures occupy a good deal of space in the Chinese newspapers. Cotton and cotton fabrics being of interest to millions in China, these subjects are made something of in the best Chinese newspapers that circulate among the merchants and the transporters of merchandise by water and draught animals.

Chinese journals with a large circulation in Manchuria —which Province is as large as Texas—note that within a year the falling off in the sales of Japanese cotton fabrics in that Province has been large, while the increase

of the sales of American cotton fabrics within the same zone for a year has been remarkable. Manchuria has bought American cotton fabrics for almost a century. A number of the New England ships that went to the Pacific coast in the early years of the last century to get furs that were sold in North China, took cotton fabrics from New England mills, and which together with furs, silver dollars and small manufactures in metals were used in bartering with the Chinese for products to go to Europe and America. The first complaints of Chinese merchants made to American commercial bodies came from syndicates of merchants in Manchuria as to the counterfeiting of American cotton goods "chops" by European and East Indian mills. Pending legislation in China as to trade marks includes a good deal of matter as to the counterfeiting of American cotton goods trade marks by Japanese, East Indian and European mills. The law to be enacted in China as to the punishment of the vendors of imported products that bear counterfeited trade marks, is confiscation of the products and long terms of imprisonment and severe fines for all concerned in the knavery. This law will be of incalculable benefit to a number of American cotton mills.

A special cause will bring about an enlargement of the exports of American cotton goods to China this year; this is the enlarging trade in soya beans to this country under which 75 cargo steamships have already been chartered for the coming season. This will bring about a very low freight rate to China in these ships that will return for another cargo of beans. The greatest factor that promises well for the increase of trade for our cotton goods in China is the edict under which the 19 modernized mints of the Chinese Empire are to work during ten years upon the new coinage of silver and bronze. This means that by 1912 the 425,000,000 units of population in China will have in circulation an amount of newly coined money that will be the equivalent of all the money that has been coined in China for a century preceding 1905. The lack of sufficient money was the main cause that brought about the consolidation of nearly all the organizations of merchants and mechanics in China to compel the Imperial Government to abolish the ancient forms of education and adopt modern methods as to systems of transportation and the coinage of money.

The lack of money for the transaction of proffered business was actually felt in China from 1901 until 1905. It was in 1904-5 that China's purchases of American cotton goods attained a total that astounded the American market. But because of lack of money and very high cost, transportation and governmental disturbances in several provinces of China, the markets for American cottons declined to almost nothing in 1907, and there followed on the part of merchants in China a sending back to this country of large amounts of cotton goods that had been bought in 1905. Almost 100,000 bales of drills and sheetings came back in this way. Yet when those reshipments were made, enormous zones of interior China were stripped bare of native and imported cotton fabrics. Those markets could not be supplied at that time because of the almost complete paralysis of transportation by water and highway, and the disturbances as to the instruments of exchange. Nine-tenths of the consumption of American cotton products in China is within a few miles of the coast and river cities. Almost 250,000,000 Chinese live where the factor of freight by the only means available, animal or human traction, is so costly that the people can not afford to buy anything which is imported.

If China can be brought by means of an adequate currency and good means of steam transportation to the average purchasing power of our country, it would be the equivalent of adding five Americas to the world. A sign of the times which indicates what our larger exporters of silver, copper and petroleum to China think of the outlook for trade in American cotton goods in that Empire is the quiet and large buying by those sagacious men of blocks of domestic cotton mill shares.

American mercantile interests in China are beginning to work for the common good of all concerned. This policy has long ruled among the distributors of American petroleum in China, who now number about 28,000, of whom the most are native Chinese wholly or partly educated by Americans, and most carefully instructed from here to do their utmost to encourage trade for American interest, as that will conduct to the general good of the petroleum industry. The strengthening of the American statistical and moral power in the commerce of China is strongly shown at Shanghai, whose annual trade for foreign account is moving at the volume of $300,000,000. Shanghai is the commercial capital of China, and is in some respects the political center of the Empire. At that port, American cottons are making better relative gains than is to the credit of any of the nations of Europe.

The Coming Meeting of the National Association.

The eighty-ninth meeting of the National Association of Cotton Manufacturers will be held on September 21 and 22, at the New Mathewson House, Narragansett Pier, R. I.

A special train of Pullman cars will leave Boston at 1:03 p. m., in the afternoon of Tuesday, September 20, in which a basket lunch will be served, immediately after the departure of the train. Special cars will leave New York at 10:02 from other points also, in time to arrive in the latter part of the afternoon.

It is expected that the interest in the golf contests will continue, as the cups offered by Ex-President James R. MacColl have been held long enough to reach private ownership. The Board of Government, by subscription among the members, are to furnish two more cups for new contests.

The several papers which were either offered too late to find a place on the program at the last meeting, or have been recently offered, are to be presented at this meeting and the Secretary desires additional papers from the members. Further detailed information will be given about September first, by which time all of the preliminary arrangements will have been completed.

Raw cotton to the value of $45,950,908 was exported from Bombay, India in 1909, a decrease of $13,595,405 from the previous year. Japan was the largest purchaser of cotton, taking in 1909, $18,855,442 worth.

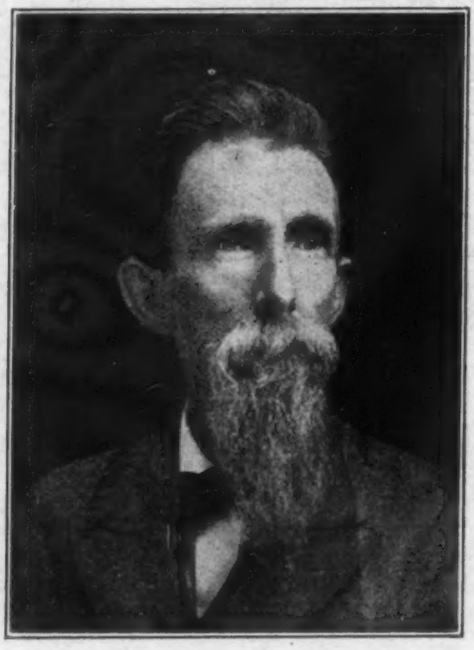
Reports from South Carolina state that the assessment on cotton mill property in that State has been reduced from 60 per cent. to a 50 per cent. basis of full market value by the State Board of Equalization.

THE EARLY DAYS OF COTTON MANUFACTURING IN THE SOUTH.*

BY OTIS G. LYNCH, AUGUSTA, GA.

There is a reliable statement that the earliest cotton factory built in the State of Georgia, if not in the South, was the Bolton factory built in 1811, on Upton Creek, in Wilkes County, Georgia. This mill, as far as I can learn, was never prosperous. Soon after this, mills were built in various places in the South. The most notable one, and the most successful one, was in Richmond County, Georgia, and known as the Bellville factory. It was located on Spirit Creek, and about 12 miles from Augusta.

In 1828, Judge John Schley, a resident of Augusta, went to Philadelphia and bought at Bridesburg, Pa., an outfit for



OTIS G. LYNCH.

a cotton mill. He brought this machinery to Jefferson County, and put it in operation on Reedy Creek, where he operated it until 1832, when he moved it to this county, and added to it until he had 100 looms in successful operation. A variety of products was made, consisting of coarse yarns, eight-ounce Osnaburgs, Georgia Plaids, which were of cotton warp and wool filling, used mostly for the clothing of negro slaves. He also had a dye house and made colored goods of various kinds, and white heavy duck. This mill was burned during the Civil War, and has never been rebuilt

Another mill built soon after Belleville was the Richmond factory. It is situated on Spirit Creek, 10 miles from Augusta, and when I came to Augusta in 1855, both of these old mills were in operation. The Richmond factory made coarse yarns, eight-ounce Osnaburgs and Georgia Plaids. The building is still standing, and I am told has some of the old machinery in it. These mills were the pioneer mills of this section.

HISTORY OF THE AUGUSTA FACTORY.

In 1855 there were only two cotton mills in the city of Augusta. They were the property of the Augusta Mfg. Co. The name was afterwards changed to the Augusta Factory. They were both situated in the same yard, but were separate and distinct buildings, each containing 300 looms, and the necessary preparatory machinery. Only one of these mills was then in operation. The No. 2 was idle on account of the stringency of the times and the scarcity of labor.

I succeeded in getting work with this company, and after a short time had most of the warp spindles in the No. 2 mill running on No. 20 yarns, which found a ready sale in the Philadelphia market.

In the previous year an agent had been sent to Scotland to procure operatives. He brought from Glasgow 80 or 90 skillful operatives. They came to America with an impression that Georgia and New England were in close proximity. Many of them had friends or relatives in the New England mills, and they took the first opportunity that presented itself of emigrating there, so at the end of a year there were not more than half a dozen remaining in the Augusta mill. The machinery in these mills was made at Whitinsville, Mass., and although it had not been long in operation, was in bad repair, and the company was financially embarrassed.

About this time a new company was formed and the mills purchased by them and placed under the control of Wm. E. Jackson, a skillful financier, as president, and Francis Cogin as superintendent. The latter was a man of tireless energy, indomitable will and a splendid judge of men, and had a faculty of bringing out the best efforts of those working under his directions. I was placed in charge of the spinning by him, and for about 20 years gave my best efforts for the success and prosperity of the Augusta Factory, and I am glad to look back over those years of toil and feel sure that my work met with the approvel of all those connected with the management of the company.

During these years the debt contracted by the purchase of the property was paid out of the earnings of the mill. A stock dividend of 200 per cent. was declared, making the capital stock $600,000, and for some years quarterly dividends of 5 per cent. were regularly declared. Besides all this new buildings were erected, new machinery purchased and the old repaired. The plant was enlarged from 600 to about 1,000 looms, and the old Augusta Factory stands to-day under the successful management of Stewart Phinizy, a monument to the ability of the South, in the manufacture of cotton goods.

THE ENTERPRISE MFG. CO.

On the first day of June, 1881, I left the Augusta Factory and took the position of superintendent of the Enterprise Mfg. Co., of this city. This mill at that time had 264 looms and the necessary preparatory machinery. About one-half of this was of English make, and having been run for several years before being brought to Augusta, was in bad condition.

The mill was entirely remodeled in 1882—the main building was extended to twice its length, a new three-story annex was added, 80x140 feet, the old English machinery was discarded, and up-to-date new machinery was purchased and put in. When this improvement was completed the equipment consisted of 600 Lowell looms and the necessary preparatory machinery and the cost was $365,997.45. This was paid for by the issuing of new stock, which made the capital stock of the company $500,000.

In 1888 a new weaving building was erected to accommodate 300 looms and the cloth room. This, with the necessary machinery purchased and installed at a cost of

*Read before Southern Textile Association.

$76,552.52, was paid out of the earnings of the mill. This increased the capacity of the mill to 900 looms. In 1899 the entire carding machinery was changed and a new and up-to-date outfit substituted in its place. This change was made without loss of production of spindles or looms and cost $120,553, which was paid from the earnings of the mill. Since then more machinery has been purchased, new water wheels and steam boilers have been put in place, and this mill stands to-day a modern cotton mill in good physical condition, containing 35,000 spindles and 928 looms.

I was in the employ of this company 25 years and one month. During this time I never had machinery idle for want of help except a short period on account of labor troubles which originated in neighboring mills. If the accumulation of wealth is the only measure of success I have not been successful. If my acts, influence or example has been a help for good to any, I am content.

MOISTURE TESTS ON RAW COTTON.

The following method for testing the amount of moisture in raw cotton is in use in the Manchester, England, Testing House, which is under the management of J. H. Lester, M. Sc., F. I. C., and was suggested for universal adoption at the recent meeting of the International Cotton Congress at Brussels.

SELECTION OF SAMPLES.

Since the object in view is to obtain a sample or samples fairly representative of bulk, consideration must be given to the suitable selection of bales, and if a given consignment contains only a few bales that have been broken or water damaged during transit, they should be rejected. If, however, a significant proportion of such bales should be found, it is better to ascertain their number and to deal with them as a separate lot. It will be recognized that it is much easier to obtain a representative sample from intact bales which are substantially in the same condition as when packed than is the case with broken bales and those that have been rain-soaked in some parts whilst remaining dry in others.

The weight of each bale should be carefully ascertained with the use of reliable machines, and in important cases it is necessary to strip the bales and obtain the tare.

No definite percentage of bales can be given as "necessary" for a reliable test, but five bales should be considered the minimum, and two per cent. should in any case be taken. If 10 per cent. is taken, it should satisfy all reasonable requirements, and this figure may be taken as a rough maximum. Whilst two per cent. will generally suffice, 10 per cent., or even more, may have to be taken from a parcel which is found to be irregular in moisture from bale to bale.

In sampling any individual bale it should be borne in mind that the best sample will be that which is collected from as many parts of the bale as possible and aggregates the greatest weight. If only five bales are being sampled, the samples may be drawn from five or six different points, but if 50 are sampled, three sampling points from each bale may suffice. In sampling a bale of cotton it is wise to bear in mind a point which theory has taught us, viz., that a truly representative sample which contains the proper proportion of cotton from the inside and from the outside of the bale would be conical in shape, the base of the cone being represented by any square or circle of the covering sacking, and the apex of the cone being represented by the middle of the bale. This view is important, because it shows that sampling as generally conducted for quality, and when the samples are taken exclusively near to the outside of the bale, is wrong, as applied to sampling for moisture, and it shows also that the method sometimes adopted by spinners who take the whole sample from the middle of the bale, is also wrong. It only requires a simple geometrical proof to show the correct method, as exemplified by the cone above referred to, but it may be said that the casual observer of correct sampling will probably remark that too much of the sample is being taken from the outer parts of the bale. It will be near enough for practical purposes to take five samples from each bale—one from the center, two from half-way between the center and the outside, and three samples from within an inch or two of the outside, each sample being approximately of the same weight.

It is obviously much better to test the whole of each individual sample for moisture than to dry only a fraction of the mixed or bulk sample, and consequently we must have regard to the capacity of our drying oven whilst drawing the samples. The largest ovens yet made for testing cotton will only make a satisfactory test of a bulk sample of raw cotton weighing up to 5 pounds, whilst a basket measuring 17 inches deep and 14 inches diameter should not be loaded with more than 2 pounds. It will be gathered from the above that the samples drawn from individual parts of the bale may be but one ounce or less in weight. The samples should be crammed into airtight tin cases immediately on taking from the bale, these cases being provided with "lever top lids," such as are commonly used for packing syrup, paint, etc. (These tins are obtainable on loan from the Manchester Testing House. If it is desired to procure the certificate of the Manchester Testing House as to the correct conditioned weight of a lot of bales, the sample may be collected by a representative who will be sent to any mill, dock, or warehouse where the cotton may be stored; otherwise the certificate will only refer to the sample and not to the bulk from which it is said to be taken.)

DRYING THE SAMPLE.

Before drying, the sample must be accurately weighed, care being taken not to expose it unduly to the air. The best method consists in weighing the sample tin with its contents, emptying out the cotton and subtracting the weight of the empty tin—not forgetting the lid. Sometimes this weighing is done in the oven itself, but this is risky, and in any case should only be done whilst the oven is absolutely cold, and not whilst hot from a previous test. After the weighing, the sample is carefully opened out, so that, if possible, it fills the basket and allows of being rapidly and thoroughly dried. The oven is now closed, and the heat maintained at 212 degrees Fahrenheit until the sample no longer loses weight. The length of time required to dry depends upon many conditions, so that time should never be taken as a guide to the completeness of drying. When from experience or otherwise it is expected that the sample is about dry, it should be weighed—still in the oven, of course—and the drying should be continued for a further 15 minutes. If any loss in the weight has been sustained during that time, a further 15 minutes drying must be given, and so on until the weight no longer decreases. We now have the actual dry weight of the sample, and it only re-

mains to calculate the results into whatever terms may be required.

CALCULATION OF RESULTS.

It is clear that the

$$\frac{\text{Loss in weight} \times 100}{\text{Original weight}} = \text{Percent. of moisture}$$

and that 100 — per cent. of moisture = per cent. *absolutely dry weight.*

It is assumed for purposes of calculation and in agreement with the adopted standard of 8½ per cent. regain, that if 100 parts of cotton in the absolutely dry state were exposed to the average conditions of the air, 8½ parts would be added due to the absorption of moisture. It is necessary then to *calculate* the *added moisture* which would theoretically be taken up by the absolutely dry cotton per cent. found in the test under consideration. This will be:—

$$\frac{\text{Absolutely dry weight per cent.} \times 8\frac{1}{2}}{100} = \text{Regain per cent.}$$

On adding together the absolutely dry weight per cent. and the regain per cent., we shall have the "percentage of cotton in correct condition" as regards moisture contained in the original weight of cotton, *i. e.*, 100. Any difference between the correct condition weight per cent. and 100 will indicate the excess of moisture above standard, whilst if the correct condition weight per cent. is more than 100, the difference will indicate the excess of cotton in correct condition due to deficiency in moisture.

The two following examples may be given:

Weight of sample taken, 810 grams, 100.00 per cent.; 933 grams, 100.00 per cent.

Loss, (moisture) 85 grams, 10.49 per cent.; 71 grams, 7.61 per cent.

Absolutely dry weight, 725 grams, 89.51 per cent.; 862 grams, 92.39 per cent.

Regain at 8½ per cent, 7.61 per cent.; 7.85 per cent.

Correct condition weight, 97.12 per cent.; 100.24 per cent.

Excess moisture, 2.88 per cent.; Excess cotton, 0.24 per cent.

Finding, as we do, that persons unacquainted with such calculations generally use another method leading to hopeless confusion and to an arithmetical quandary, it is necessary to point out that cotton is *not* in correct condition when it *contains* 8½ per cent. of moisture, but only when it contains 8½ parts of moisture together with 100 parts of absolutely dry cotton. Calculating this out, we find that *cotton in correct condition contains* 7.834 per cent. of moisture. Nor, again, would it be correct to say that if cotton contains 9.834 per cent. it will have exactly 2½ per cent. excess of moisture. There is only one correct and satisfactory method of finding the amount of excess moisture or excess cotton from the percentage moisture, and that is by the use of the method first given under the heading, "Calculation of results."

In calculating the weight to be invoiced when it is agreed that the 8½ regain standard be accepted, it is necessary to first find the weight of the whole parcel (as calculated from the bales weighed for the test), and to deduct from this weight the percentage of excess moisture found in the test, or, alternately, to add the excess cotton similarly ascertained.

If the invoiced weights of the bales vary considerably between each other, it is necessary to use the following calculation:—

Actual weight of bales sampled multiplied by the total invoiced weight of bales, and this divided by the invoiced weight of bales sampled, the result giving the calculated weight of the bales, from which the excess moisture has to be deducted or to which the excess cotton percentage must be added.

THE STANDARD OF MOISTURE.

Raw cotton or cotton yarn is said to be in correct or standard condition when it contains 7.834 per cent of moisture. This figure is based upon the standard or official "regain" of 8½ per cent., and is adopted by all Testing and Conditioning Houses. It is assumed that 100 parts of absolutely dry cotton (dried at 212 degrees Fahrenheit) will take up or "regain" 8½ parts, by exposure to the average conditions of the atmosphere. In point of fact, any method based upon the exposure of absolutely dry cotton to the atmosphere is unsatisfactory, since many weeks of exposure are necessary to allow cotton to absorb all the moisture it can, and also since even after such exposure it will not contain as much moisture as a sample exposed to the same conditions of atmosphere but not previously exposed to the drying process. It is quite true that cotton loses some of its moisture-absorbing property by drying at 212 degrees Fahrenheit. This last-mentioned fact gives no ground, however, for the statement we have heard made to the effect that drying at 212 degrees is unfair because it destroys the character of the cotton, and no reasonable exception can be taken to the process, except that the drying may possibly spoil *the sample* for certain very delicate purposes. Samples are, however, commonly of little value, and should always be regarded as waste.

If the standard of moisture in cotton were placed at a higher figure than 8½ regain, stocks showing this higher figure would decrease in weight, whilst if a lower figure had been adopted, they would continually increase, adapting themselves to the surrounding conditions of the atmosphere. In point of fact, the 8½ standard agrees very well indeed with the average conditions existing in warehouses or in any place under cover and not artificially warmed, and it is further a practically ascertained fact that cotton containing the standard of moisture does not gain or lose in weight under such conditions. It is worthy of note that cotton containing but a small excess of moisture is liable to mildew, and this constitutes perhaps the best reason why the standard should at any rate not be increased.

TEMPERATURE OF DRYING.

The temperature at which samples of cotton are dried is generally 105 degrees Centigrade (221 degrees Fahrenheit) on the Continent, but the Manchester Testing House has hitherto dried at 212 degrees Fahrenheit, mainly as a concession to those who have been afraid of having the cotton heated higher than the temperature of boiling water. There is no appreciable difference in result, and Herzberg has recently shown that the result of drying cellulose shows no appreciable difference between 90 and 120 Centigrade. Higher temperatures for test drying are an advantage in point of rapidity, and any objection raised against the use of such temperatures has been based, if it had any substantial foundation, upon the fact that many drying ovens of obsolete pattern give much higher temperatures in some parts than where the bulb of the thermometer may

chance to be. In one such type of oven some parts of the sample may be heated to 220 degrees, whilst the thermometer shows only 190 degrees or less.

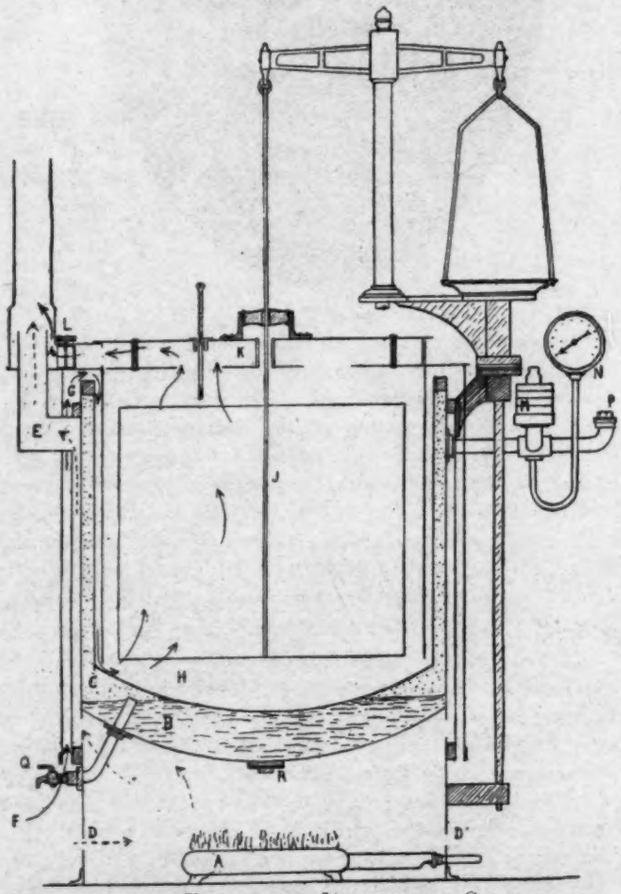
A drying temperature of from 200 degrees to 220 degrees Fahrenheit is most suitable, because, even if the sample is heated rather more or less strongly in places or inadvertently, the result will not be affected. Since a suggestion has been made recently from an influential quarter that cotton should be exposed to the average conditions of the air in order to ascertain its true "air-dry" weight, it may be remarked that such suggestion can only be based upon entire ignorance of the hygroscopic properties of cotton and of the insuperable practical difficulties of such procedure. Even if it were practicable, no advantage could possibly arise out of the adoption of such methods.

THE DRYING OVEN.

The best type of oven is provided with a steam jacket and a dead-weight safety valve, set to blow off when the pressure exceeds a certain point. This ensures the temperature not rising too high, and gives audible warning of such danger.

The oven should permit of the sample being weighed inside without removal. The practical advantage of being able to weigh the sample from time to time is considerable, both in respect of time-saving and since the operator has little or no inducement to curtail the time of drying by reason of the trouble of taking from the oven to weigh.

The ovens now in use by the Manchester Testing House are of the steam-heated type, the illustration given being of one steam-heated by means of gas. Where steam is available the connection can be made at the filling cap P, and a steam trap connected at R. The sample is suspended in the basket J from the beam of a balance capable of being easily swung aside for removal of the basket. The gas burner A, gives up most of its heat to the water B in the steam jacket C, much of the remaining heat in the burnt gas being given up to the jacket before leaving the apparatus at the chimney E. The air necessary for drying the sample is introduced at F, rises through the annular space to G, descends in contact with the interior of the steam jacket to the bottom of the drying chamber, and ascends through the sample at J through the double lid K and the damper L to the chimney. At M and N are shown the dead weight safety valve limiting the maximum temperature attainable, and a pressure gauge. Such an oven requires a pressure of about 20 pounds of steam to maintain a temperature of 212 degrees Fahrenheit in the drying chamber. The sample basket measures 20 inches deep by 20 inches diameter, and will hold not more than 5 pounds of raw cotton without undue crushing.



OVEN FOR TESTING FOR MOISTURE IN COTTON.

Experiments have been made by the Testing House, showing the impracticability of drying in vacuo, though such method would appear at first sight attractive.

LOSS IN MILL WASTE.

BY HARVIE JORDAN, PRESIDENT SOUTHERN COTTON ASSOCIATION.

The ginning of cotton when wet is exceedingly injurious to the fiber, causing the lint to be torn, cut and mutilated by the gin saws. This decreases the value of the lint for spinning purposes, and thereby its market value to the spinners. Cotton should be thoroughly dried and delivered to the gins in the cleanest and best possible condition, in order to secure the maximum market value for the lint. At the large compress plants the big plantation bales, which are full of air, are subjected to an instantaneous pressure, reducing the bales from a width of 48 inches to 8 inches in a second. This forcing out of the air so suddenly oftentimes cuts and mutilates the fiber causing an additional loss to the spinners in mill waste, as these short and broken fibers can not be woven into yarn for the manufacture of cloth. Mill waste is also increased by the spinning of lint cotton which has been exposed to the weather or injured from bad treatment in any other way.

It is estimated that from these and other causes the average amount of mill waste is about 8 per cent. of the raw material worked. According to these figures the mill waste from the American cotton crop each year amounts to several hundred million pounds of lint. The spinners and manufacturers are forced to sell this mill waste at from one to two cents per pound, and it constitutes one of the heaviest losses and most troublesome items in the whole manufacture of American cotton.

The losses in the manufacture of foreign grown cotton is reduced to a minimum, due to the better handling of it. The average total loss in the spinning of an American bale of cotton is about 15 per cent. of the gross weight of the bale. In other words, a spinner will usually get out of a 500-pound bale of American cotton, 425 pounds of commercial yarns, the balance or the 75 pounds is lost in bagging and ties, sand, trash, mill waste, etc. The spinners are too shrewd business people to pay the growers for more than what they can actually utilize out of a bale of cotton, hence

the more good lint we can get into a bale of cotton and the less tare, sand, trash, and mutilated fiber, the nearer the grower will come to receiving the maximum value of his lint cotton for spinning purposes.

It must be borne in mind that the spinners are the real customers and not the buyers to whom the staple is sold. The spinners consume, while the buyers handle the raw material between the growers and the spinners, hence cotton is grown for the spinners and not for the buyers. Therefore, the needs of the spinners should be more closely studied, and their requirements conformed to as nearly as possible.

ECONOMY IN BALING AND HANDLING COTTON.

It is frankly admitted by spinners and exporters of American cotton that any reform in the present bad methods of baling and handling the crop must be done through the medium of gin compression. In this respect it will be wisdom and economy for Southern cotton growers and ginners to adopt the methods which have been pursued in Egypt and India for generations, that of compressing bales of cotton to the required density for transportation purposes at the local gin plants of the South. The spinners have for years pleaded for the introduction and adoption of gin compression in the South, as it is carried on in all foreign countries where cotton is grown for export.

The spinners prefer the usual type of square bales, weighing on an average of 500 pounds, uniform in length and breadth and compressed to a density at the gin of 30 pounds to the cubic foot. With the adoption of such a package, full car load shipments could be made direct to the ports from the initial point of shipment. The cost of tare, storage, insurance, country damages, sampling, stealage and other vexatious losses which now burden the American cotton crop could be quickly eliminated. High fixed charges would be speedily reduced and the growers could market a modern commercial bale of cotton suited to the needs of the spinners upon the most economic basis. The cotton trade and transportation companies could handle gin compressed cotton with much less expense and loss of time, which is money.

Modern invention has perfected presses which can be installed in local gin plants and meet all the requirements of gin compression. It is quite evident that the introduction of these needed reforms will save million of dollars annually to the growers of cotton and enable them to secure all of the advantages and benefits arising from the utilization of modern invention and thought in the future handling and marketing of this great agricultural product. Primitive methods belong to the past, and should have no place in 20th century progress. There is no longer need of perpetuating a system of waste and extravagance in the handling of the cotton crop, which is so expensive to the growers and gives the spinners so much discontent. A bale of cotton is the richest heritage of the South, and we should unite to see that it is delivered into the markets of the world in first-class commercial condition, and upon the most economic basis.

The value of exports of cotton piece goods from Great Britain in 1909 was $366,908,200, an increase over 1908 of $22,277,300.

An attempt has been made to develop a weaving industry at the port of Newchwang (China), and several handlooms have been set up.

PRODUCTION INCREASING METHODS—TRAINING WORKMEN.*

BY HENRY L. GANTT, NEW YORK CITY.

There are two ways only of increasing profits; one by increasing the selling price, the other by reducing the cost of production. Let us consider that of reducing cost, and ask why more attention has not been paid to it, and what we may expect to get if we cultivate it assiduously. The first cause is that it can not be done in an easy chair behind a mahogany desk. It must be done in the factory amid the dirt, the dust and the noise of machinery. It must be done by not only studying individually the machines that do the work; but by also studying individually the men that operate them. This is work that requires quite as much, if not more, ability than the making of prices; it also requires long hours and overalls; and the compensation

HENRY L. GANTT.

for success does not compare with that accorded the man who adds to the bank account by manipulating prices.

The horizontal increase of wages being granted by so many corporations throughout the country is not a cure, but an expedient only to enable the workmen to supply themselves temporarily with a larger proportion of the necessities of life. Such a scheme provides temporary relief only, for a general increase of wages increases costs again; and, if such a policy is followed, it will not be long before a new increase of wages will be needed to meet the continually rising cost of living.

The one cure, and the only one for the condition that confronts us, is to increase the efficiency of the producer. A few years ago efficiency was a local question; to-day it is a national question and co-operation for its promotion will not only be of great permanent benefit to those co-operating but have a great educational effect on the nation at large. It may be interesting to glance at some of the methods by which efficiency has been increased.

There are in nearly every factory, a few workmen who

*Read before the National Association of Cotton Manufacturers.

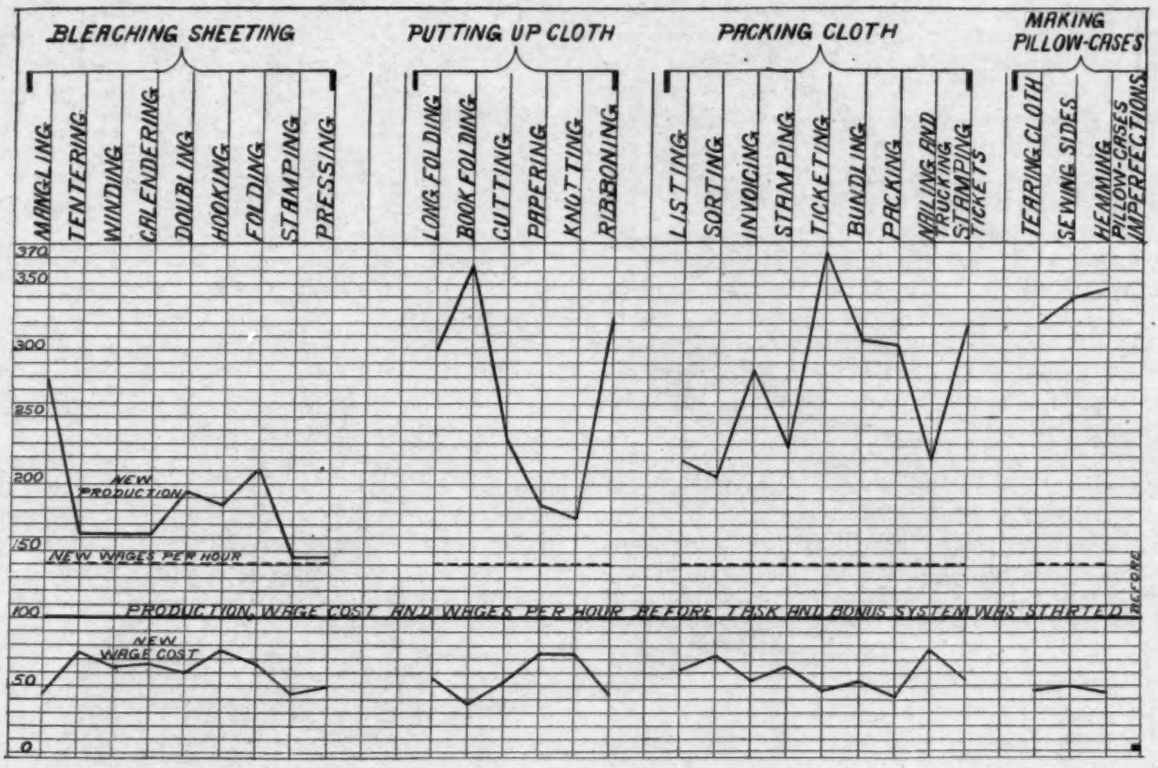


FIG. 1. DIAGRAM SHOWING BENEFITS OF TRAINING IN A SHEET AND PILLOW CASE FACTORY.

are much more efficient than the average, and we all realize that if we could only get the average efficiency up to the highest efficiency, our output would be greatly increased and our profits increased in a much greater ratio. Few of us, however, realize how much greater this ratio would be. In many cases our efficient worker can do twice as much as the average, but he seldom does it, because as a rule he isn't satisfactorily compensated when he does. If by any means the amount of work done by the average worker can be doubled, and the output of the plant increased correspondingly, the profits will, unless they are already very large, be increased at least 300 or 400 per cent., even though wages may also have been increased 50 per cent.

These facts, which can be readily verified by applying them to any ordinary manufacturing business, indicate in the clearest possible manner, the desirability of increasing the efficiency of our workmen. Moreover, the profits to be derived from such an increase are so great that the manufacturer can not afford, as has been too often the case in the past, to trust to "picking up" suitable workmen when he needs them, or to hiring them away from his neighbor; but must make proper provision for training such workmen as he may need. A method of doing this in a prompt and satisfactory manner is one of the greatest of our industrial needs to-day.

Many managers have recognized this fact and are establishing schools for the combined education and training of workmen. So far, however, they have been able to make but a comparatively small addition to the number of workmen needed. If we wish to train workmen in large numbers, the practice must become much more general.

With the coming of the factory system, the owner became too busy to give much personal attention to the apprentices, and, as the factories grew larger, he was often unable to take from the business end enough time to make himself a master workman in all branches of his work. With the increasing size of the factory, the superintendent also became too busy to give much personal attention to the apprentices, and they were thus left to receive their training from the foreman and their fellow workmen, who have no financial interest, as a rule, in training additional workmen who might, in time, become their competitors. This is undoubtedly the most important reason why the old apprentice system has gradually become less effective, until to-day it is almost obsolete. It is also a good reason why an attempt to revive it in its old form is foredoomed to failure.

If the training is based on the results of scientific investigation, and the methods employed are those which embody our best knowledge on the subject of teaching, we should be able, not only to provide ourselves with an abundance of skilled workmen, who are capable of doing well the tasks set them, but develop many who are able to advance the mechanic arts in a manner superior to that which gave the New England master workman of a generation ago such a wide reputation. For several years past the writer has been training workmen on the lines indicated above, and although his work has usually been with people older than the ordinary apprentice, his results have been successful to a degree entirely unanticipated.

About 500 of those so trained are textile workers who are now earning an average of 40 per cent. more than previously, and turning out over 100 per cent. more work. The average wage cost per unit has been reduced to about 60 per cent. of what it was, and the total cost to a much greater extent.

Figure No. 1, represents graphically the results of this work in a number of specific cases. In this diagram, the condition before the training was begun is represented by one hundred; the new condition is represented as a per-

centage of the former. If, then, the ordinates of the unit line represent the previous output, those of the upper irregular line represent the new output. It will be noted that the new output ranges from 50 per cent. to over 200 per cent. greater, averaging in the cases shown over 150 per cent. greater. On the same diagram, assuming the previous wage cost as unity, the new wage cost is only about 60 per cent. of what it was, while the new hourly wage on the same basis is about 40 per cent. greater than the old. We have thus increased the output over 100 per cent., reduced the wage cost 40 per cent. and increased wages 40 per cent. Inasmuch as in most cases this result has been obtained with but little permanent increase of general expense, it may be realized that the profits have been increased to a degree that is hardly appreciated at first sight.

The diagram represents various classes of work, the first being that of the several operations of finishing and folding sheeting in a bleachery. The second class of work is that of sorting and packing piece goods from a storehouse. The third class is that of folding and putting up "fancy" goods in a bleachery. The fourth is that of running sewing machines, making sheets and pillow cases. In the last case, the increase was so uniformly great, that one immediately feels that the work must have been done in a very inefficient manner before. It unquestionably was, but probably not much more so than is often found when the work is left entirely in the hands of a foreman whose only qualification for the job is the recommendation of one of his friends. The methods inaugurated by the writer in this factory are being extended by men trained under his direction, and soon all the operations will be done efficiently.

One other result, which was to be expected in a general way, is that the trained workman, working under expert teachers, should also produce better work, but we were not quite prepared to find the extent to which this was so in some cases.

In the Sheet and Pillow Case Factory (represented on Chart 1) we were enabled by a fortunate combination of circumstances to get a measure of this increase, which was so surprising that we hesitate to take it as a fair sample. However, it may be taken as an example of what may happen. Soon after the establishment of these methods in the sheet and pillow case factory, there was a complaint from one of our customers that our work was bad. An investigation proved that the complaint was well founded, and about 50 cases of sheet and pillow cases were returned. On inspecting them it was found that while there were a great many defects in some cases, others were practically free from defects. After this fact was noted, an exact record was kept of all the defects in each case still to be inspected, with the following result.

In 28 cases done before we put our new methods in operation, the number of defects per case averaged 47½. In two cases done while we were starting the new methods, and before we got proper inspection in operation, the average number of defects per case was two. In eleven cases done after the new methods were installed completely, the average number of defects per case was less than one.

If we wish to improve the ordinary workman up to a point where his work compares favorably with that of the efficient workman, we must do so by making it to the financial interest of the ordinary workman to learn, and to that of the expert workman to help up teach, for the ordinary workman must be taught and trained. We must study the work of the efficient man and get a measure of it to use as a standard for the poorer workman to come up to.

Again, we often find that by a study of the work of the efficient man, or men, we can find a still more efficient manner of doing the work, which we can teach to the ordinary worker. Having determined the best method and the time needed by an efficient workman to do any piece of work,

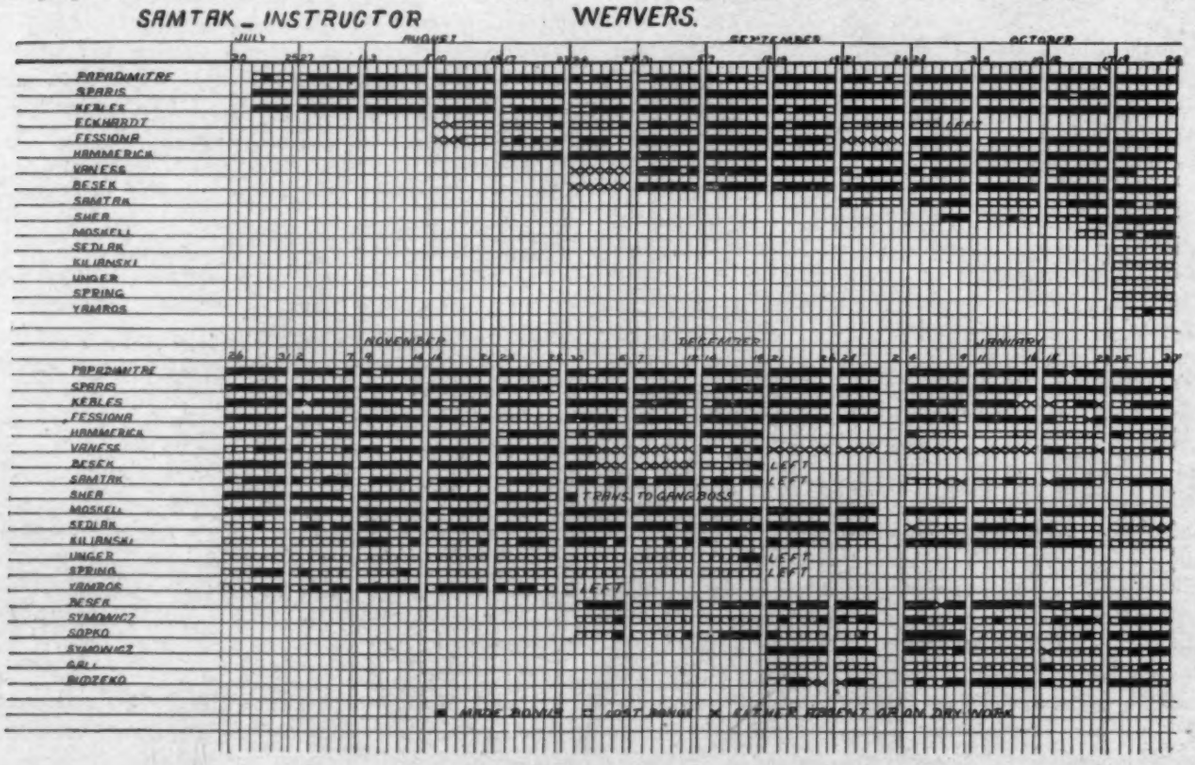


FIG. 2. RECORDING SYSTEM IN THE TRAINING OF WEAVERS.

we set that time and method as our task, and if the ordinary workman learns to do the task in the manner and time set, he is paid a substantial addition to his day's pay. Our efficient workman is made an instructor and receives each day additional compensation for each workman under his charge who comes up to the efficiency set.

Charts 2 and 3 show what can be done toward increasing the efficiency of workers in a cotton mill. A glance at the names will indicate the class to which they belong. They are nearly all immigrants and few can talk English, but *it has been possible to bring the average efficiency up to a higher point, than that of the best worker before we began our study, for the task as finally set was more than the best worker had been doing before we began to study his work.*

Our method of procedure, in the weave room for instance, was to select the best weaver in the mill, (in this case it happened to be a Pole named Samtak,) and study day after day how he did his work and what was limiting his output. Then means were taken to remove the obstacles that had prevented him from doing more or better work. After this we again studied his work in detail, timing his various operations with a stop watch, and finally deciding what a fair task was when conditions were right. We then made Samtak an instructor, and set for the three next best weavers the task of doing each day what Samtak proved could be done.

When they succeeded they were paid a substantial bonus in addition to their day's pay, and Samtak was also paid a bonus each day for every successful weaver. While Samtak was a good weaver, he was at first a poor teacher, and our investigator who had studied his work and who was a good man of college training, was obliged to remain with him for several weeks before he became a good instructor, and able to remove obstacles that interfered with efficiency.

Charts 2 and 3 represent what we accomplished in training weavers between July, 1908, and October, 1909. The record of whether a weaver succeeded or failed in his task is represented on the chart each day.

The heavy vertical bars divide the charts into weeks while the light vertical lines represent days. When a weaver was successful on a day his space for that day was blotted out. When he failed his space had a black line top and bottom. A cross represents that he was either absent, or had no task set for that day, but simply worked by the hour. Note, that we started with a few of the best weavers, and did not try any more until the first ones had formed the habit of being successful. Then we took the next best weavers. Note that we soon ran out of weavers who could perform our task at the start. Gradually, however, the chart became blacker as time went on until in October, 1909, nearly all of those who had been trained are regularly up to the required efficiency, which refers to both quantity and quality, for failure in either causes loss of bonus. In addition to paying our instructor a bonus for each weaver that succeeds, he is paid additional bonus if all succeed, which has the effect of causing him to help the inefficient workman.

The mechanic who keeps the looms in shape is also paid a bonus each day for each weaver who succeeds. Every case of failure to make a bonus is investigated by somebody in authority, with the object of finding out the cause and removing it; and inasmuch as it is to the interest of all concerned to have the cause removed, he always has their hearty co-operation, with the result that the workman and foreman combine with the management to obtain high efficiency. This would seem utopian if it were not an accomplished fact.

Many will say that it is not possible to introduce such a system into their plants, and they are right under the

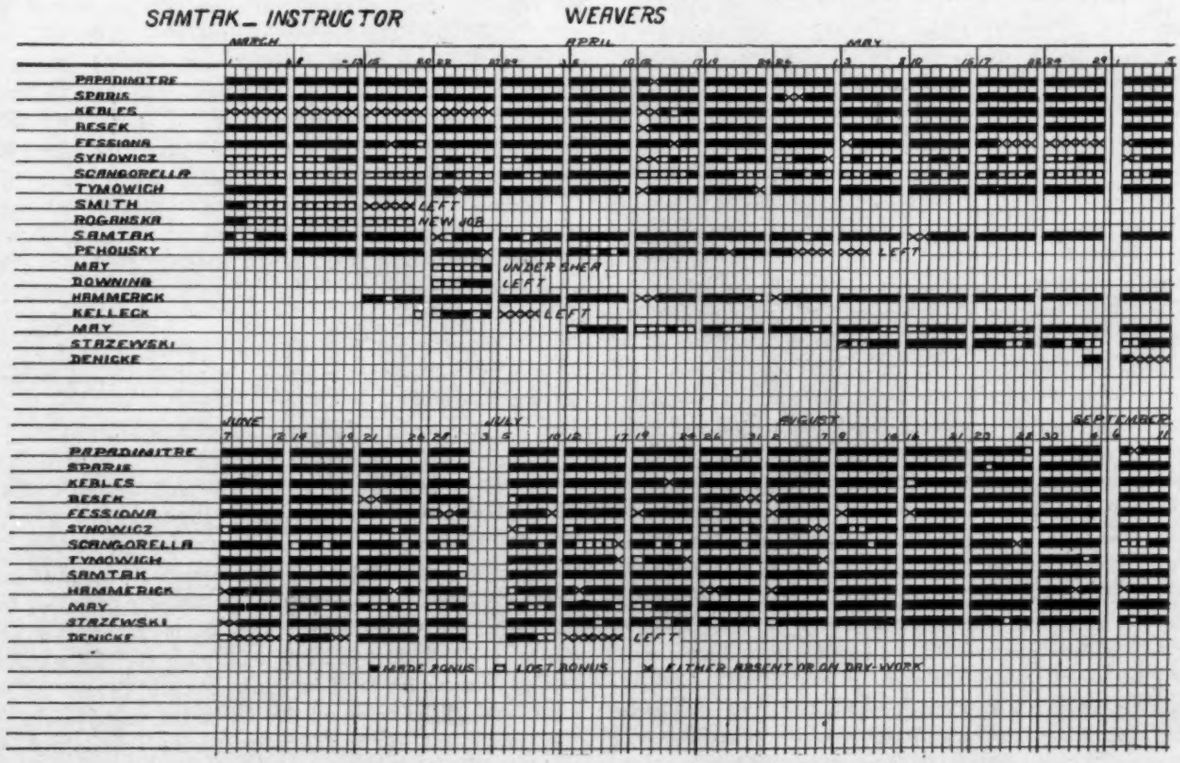


FIG. 3. CONTINUATION OF THE RECORDING SYSTEM SHOWN IN FIG. 2.

conditions that exist in those plants; but their system of management can gradually be so modified, that the introduction of such a system is possible. The first step is to so plan the work and arrange such a system of returns that an individual record can be kept of the work of as many men as possible, and to base their compensation on their record. Where there are no established piece rates, this will do much to insure efficiency, and the clerical work needed will be insignificant when compared with the benefit obtained.

Time and space will not permit of our going into more detail, but it is sufficient to say that the development of skilled workmen by this method is sure and rapid, and whenever the method has been properly established, *the problem of securing satisfactory help has been solved.* During the past few years while there has been so much talk about the "growing inefficiency of labor," the writer has repeatedly proved the value of this method in increasing its efficiency, and the fact that the system works automatically, when once thoroughly established, puts the *possibility of training their own workmen within the reach of all manufacturers.*

The result of our twenty years' work on these lines is now being collected and will shortly be published in a book entitled, "Work, Wages and Profits."

CENTRAL STATIONS VS. ISOLATED PLANTS FOR TEXTILE MILLS.

(Continued from March.)

THE COST OF WATER-POWER.

The cost of water-power depends upon a great variety of factors, but the essential feature is usually the fact as to whether the combined result of all these factors is such as to make the cost of the development per horse-power delivered, a reasonably small amount, so that the fixed charges shall not be excessive. In other words, the allowable cost of water-power can not be materially more than the net cost of producing the same amount of power for the same purpose in some other satisfactory manner, usually by steam. The cost of maintaining and operating a supplementary steam plant to make up for the shortage of power during low-water, flood periods, etc., must be carefully considered as it affects the actual cost of power delivered from the hydraulic plant.

For the reason that water-powers usually have high independent charges, they are more valuable for use on loads with high load-factors than with low load-factors, and hence are more valuable for 24-hour power than for 10-hour power. Many of the modern developments are of very large size, and the cost per horse-power of the plant is in some cases small. In the determination of the cost of power, the cost per horse-power of development should not be allowed to confuse or cause misrepresentation of the actual cost of power delivered. Usually the larger the development installed, the smaller is the cost per horse-power of development, but it does not follow in all cases that the cost of delivered power will be smaller per horse-power. There are usually more elements of chance and more unknown factors in an hydraulic development than in a steam plant, and these facts should be taken into consideration and properly cared for. It is the lack of consideration of some of these items that has caused some of the water-power developments to get into disrepute. On the other hand a development properly made and at a reasonable cost is a valuable asset and one which bids fair to increase in value if the price of coal increases in the future as in the past.

VARIATION IN VALUE OF WATER-POWER.

The value of an hydro-electric power to various industries will in approximately the same ratio as the cost of producing power in some other way, if considered as power, pure and simple, without taking into consideration other important items affecting the business, which are sometimes more vital than the cost of the power itself. To illustrate the value and cost of power under different conditions, it may be well to mention the two following cases:

A price for hydro-electric power was submitted to a color textile mill, of 1.2 cents per kilowatt-hour. After due consideration, it was decided that the mill could not afford to accept the offer, the principal reasons being: (1) On account of the use of steam for manufacturing purposes, and of the water of condensation for dyeing, the net cost of steam power would be less than the price of hydro-electric power. (2) It was considered better for the textile company to own and control its own plant, if it had the capital to build it, than to purchase current brought over many miles of pole line, and be tied up to some foreign company.

The cost of power per kilowatt at the switchboard from the hydro-electric company for the operating time of the mill was about $36 per kilowatt-year; and for the steam plant which the mill was proposing to install this cost was estimated at about $34 per kilowatt-year. But if the power had been bought from the hydro-electric company, the mill would have had to install and operate a boiler plant nearly as large as the one required for both power and manufacturing. It was estimated that the use of the waste products from the steam plant would reduce the net cost of the power at least $8 per kilowatt year.

In another case an offer from a hydro-electric company was made to furnish power at 1.2 cents per kilowatt-hour, the same price that was refused by the color textile mill. For a plain cotton mill it was decided proper to accept the offer. The principal reasons for accepting it were: (1) 1.2 cents per kilowatt-hour—about $36 per kilowatt-year, or $27 an electric horse-power delivered. This, reduced back to one horse-power, equals about $23.50 per year, which was very near the estimated cost of steam power for the quantity required and at the price of coal for this particular industry. (2) The mill desired to postpone the expenditure necessary for a steam plant if it could be done without serious loss.

CENTRAL STATION BUILT BY MILLS.

Steam central-station plants for the distribution of power to textile mills are being built and operated by the mills themselves to a considerable extent, because it is acknowledged that a central station of large capacity can be run at less expense than several isolated plants, if considered for power only, without considering the other uses for steam and warm water. It is doubtful, however, if a central plant located at such a distance for the manufacturing processes as to make it necessary to forego the saving which can be made by the use of the waste product of the steam plant, can be run as economically as several scattered plants from which low pressure steam and condenser water can be made of use. In some plants, it becomes

a necessity to abandon this advantage owing to the growth of the plant and the necessity of separating the power plant from the mill. Other advantages may be derived by the concentration of plants which warrant the change. Nearly all of the recently built concentrated plants are for electrical transmission.

HYDRO-ELECTRIC STATION.

There are comparatively few hydro-electric plants owned by other corporations which are supplying textile mills in the North with a portion or all the power required by them. The reasons for this are as follows: (1) Power costs more and can be sold at a greater price. (2) The power plants of textile mills are usually of a sufficient size to make them fairly efficient in fuel economy and fairly cheap to run in other respects. (3) There is usually no large amount of reserve machinery as the service is not severe, and as it is owned and controlled by the company itself, it can take some chances which could not be taken by a power company furnishing power to the mill.(4) The power plant is one of the items that goes to make up the whole plant, and is so considered. It is usually of very little trouble or care to the manager, and requires no additional salaries outside of the ordinary engineers. (5) The item of depreciation is not so great as it is in a central power station, for in the mill the cost of power is a small percentage of the value of the product and there is not the necessity of change so frequently in order to get the utmost economy that there is in a power station whose product is power only.

(6) With the mill plant, there are no large charges to be made in transmission costs and losses, to selling and metering the power, to franchises, administration and other charges which are necessary and common to central power stations. (7) The most favorably situated and least expensive hydro-electric developments can make power and distribute it and sell it to plain textile mills at prices which will be attractive, but it will be quite difficult to sell at prices low enough to compete with the net cost of power to the color textile mills which use their steam power to the greatest advantages from power and manufacturing processes. (8) Surplus power which can be furnished for less than the whole year must be sold at low prices as the mill must maintain its steam plant for emergency use ,and run it when necessary, thus adding to the cost of purchased power the fixed charges on the steam plant, and such operating costs as may be met from time to time.

In the North but few of the textile mills have purchased power from any central station either steam or hydro-electric, but in the South, it is not uncommon practice for the mill to purchase hydro-electric power. Some of the reasons for this are as follows:

Most of the mills in the North are older than those in the South and were built previous to the time of electrical transmission of power. They were, therefore, equipped with their own power plants, either water or steam, or both, and having made the investment there is not the incentive to change, whereas, a new plant might save considerable investment by the purchase of power. Most of the Southern mills are plain white mills, requiring no large amount of steam for dyeing and finishing, and requiring also less steam for heating the mills.

The mills of the North average larger in size than those in the South, and the larger the plant, the less the cost of power per horse-power, other things being equal. As a rule, the Northern manufacturers are more accustomed to the supervision of their power plants.

CENTRAL STEAM POWER PLANTS OWNED BY OTHER INTERESTS.

There are still fewer textile mills purchasing current from central steam plants, and the reasons for this are the same as stated for the hydro-electric stations. The central station men claim that the mills do not know how much steam power is costing them. This may be true, in many instances, but not in all. The larger miils know the cost pretty closely.

ADVANTAGES TO PURCHASERS OF ELECTRIC POWER.

Some of the advantages to the purchaser of electric power are as follows: (1) In a new enterprise, in which the power plant has not already been constructed, there will be required less investment for the power plant with the purchase of current, than if the power is produced by the company itself, and the manufacturing company will have more capital for other uses in its business. (2) Less space will be required on account of the omission of the power plant, and perhaps a better arrangement of buildings can be made on that account. (3) There will be less care to the managers of the mill if the power is purchased than if it is produced by the mill, but in a textile mill this does not usually seem to be very serious. (4) The company is enabled to postpone the introduction of a power plant until some later date, and in that way is able to take advantage of any improvements in power plant equipment which might be brought about during the time that current was purchased.

For the above reasons, I should expect that a mill would be willing to pay something more than the bare cost of power if the power were purchased from outside, but the mill should determine what the net cost would be from its own power plant, taking into consideration not only the cost of power, but also the saving due to the use of low pressure steam and warm water for manufacturing purposes. If power is purchased, there must usually be added the cost of running a boiler plant at the mill for heating and manufacturing purposes in making the comparison with the combined plant at the mill for power, heating and manufacturing purposes. For the above reasons, the central station will have difficulty in contracting with large textile mills for power except under the most advantageous conditions for the central station and the most disadvantageous conditions for the textile mill.

CARAVONICA COTTON AND KAPOK.

The cotton spinning mills of Germany are deeply interested in the cotton output of its African possessions, especially in view of the fact that at the recent Colonial Exhibition at Berlin the largest spinning mill of the Chemnitz district exhibited fabrics made partly from Togo cotton and partly from Caravonica cotton. This is the first time that fabrics made from Caravonica cotton of such a great variety of texture and patterns were placed on exhibition. The same applies also to kapok, another colonial growth, from which fabrics are also exhibited by the Chemnitz mill. It was at the instigation of the manager of the latter that careful experiments of manufacturing fabrics from Caravonica cotton and kapok were taken up in Germany, and the results have been more than satisfactory. The latter two fibers seem to flourish in the German African colonies, and production on a large scale is now being attempted.

The Textile Mill Situation in the South and New England.

SOUTHERN MILL SITUATION.

(Special Correspondence)

Conditions affecting Southern textile interests during July did not differ greatly from those of the preceding month. Curtailment of production has been the feature of the past month, and will continue to be through August. It is not overstating the facts to say that the mills of the South have curtailed more sharply during July than in any similar period in the history of cotton milling in this section. The majority of mills in the Southern manufacturing States closed down entirely from one to two weeks during July, and will do likewise in August.

The big mills of South Carolina and other States decided some time ago to shut down entirely at least two weeks during the months of July and August. Whether or not the present plans of curtailment will be increased later on remains to be seen. Unless there is improvement in the demand for goods, some new curtailment plans will have to be inaugurated, as mills can not afford to operate when they lose from two to five cents a pound on their product.

Raw cotton has been selling at 15 and lately at 16 cents a pound, while prices offered for manufactured goods are based on 12½ cent cotton. It is argued that mill organization will not be seriously disturbed, because when mills began to shut down systematically, it was too late for operatives to go to the farms.

From the stand-point of the operatives, it is argued that they can best stand idleness during the summer months than in the winter when the cost of living will increase their hardships.

Several important meetings were held during July, among the most important being that of the South Carolina Cotton Manufacturers' Association, at Spartanburg. The object of this meeting was to adopt plans for securing cheaper freight rates on coal, etc. The matter is now in the hands of a committee who will confer with officials of the C. C. & O. R. R. and other roads.

At this meeting it was stated that the actual stoppage of spindles in South Carolina for at least two weeks in July and August, amounts to 3,622,000 spindles out of a total of 3,711,000 in the Association. This will give an idea of the extent to which the curtailment movement in the South is being prosecuted. It is further estimated that the curtailment during July and August in South Carolina alone will amount to at least two and one half million pieces of cloth.

The Executive Committee of the South Carolina Cotton Manufacturers' Association will meet again at an early date to consider further curtailment for the latter part of the month and the first of September.

Another matter of importance coming up at the recent Spartanburg meeting was the consideration of a uniform price of goods, although no definite statement was given out relative to the action taken. Fifty-five manufacturers attended the meeting.

It is estimated that curtailment among cloth mills of the South at present amounts to from 30 to 50 per cent. and among yarn mills from 50 to 65 per cent. It is believed that stocks have been reduced and that with the curtailment planned they will have been cleaned up so that by fall there will spring up a healthy demand for goods of all kinds. By September the size of the new crop will be fairly well known and manufacturers are looking for a revival in trade at that time.

Many of the mills of the South declared their regular semi-annual dividends during July, despite the unfavorable conditions in the industry. For example, in Greenville, S. C., alone dividends amounted to almost $300,000, which is an increase of $10,000 over the mill dividends of January.

There is no let-up in new mill construction, however, in spite of the demoralization of the trade. In Georgia, Alabama, the Carolinas and elsewhere, numerous large new mills have been built, and extensive improvements made in established plants.

NEW ENGLAND MILL SITUATION.

(Special Correspondence.)

While many factors have developed in the cotton mill situation in New England during the past month that have been very unpleasant and disturbing, it is generally understood that those who are closest to the selling end believe that the low point has been passed, and that from now on, with slight reactions, there will be continuous improvement. Already the Western States have responded to the apparent discrepancy between selling price of fabrics and cost of raw materials and have placed large orders for immediate delivery. Curtailment continues to increase and present indications are that another month will see shelves covered with dust instead of fabrics. Labor conditions are quiet and mill shares hold firm.

Commission men are feeling better about the market, and are turning down offers at a slight concession under the market for spot delivery and are refusing orders for future delivery, except at prices that will show the mills a profit on 13 to 14 cent cotton, for it is the general opinion that cotton will not sell for lower than 13 cents for many months to come. A large Boston commission house turned down an export order for 10,000 bales of wide sheetings last week at 3-8 cents under the current quotations because their mill could not make a new dollar for an old one at the price bid. Another commission house refused to enter an order amounting to $62,000 for winter and early spring delivery, because the raw cotton that would have to be used in the manufacture of the fabrics would have to be purchased for less than 12 1-2 cents a pound. There are many other illustrations that might be cited to emphasize the fact that commission houses are confident that conditions are improving and prices must harden considerably before long if raw cotton holds as high as at present.

Curtailment is very general in New England except in New Bedford where there is very little decrease in production. In Fall River, every mill with very few exceptions, is curtailing from one to three days a week while the Fall River Iron Works and allied Borden mills are cur-

tailing a large part of the time. It is entirely probable that the curtailment schedules will operate until Labor day, and then the situation will doubtless be so improved that mill agents will be able to ignore that condition of "concerted curtailment" which is so dreaded in any industry.

Prices of fabrics are firmer. New lines of ginghams have opened up well and are selling better than one year ago. Prices are firm and appear satisfactory to consumer and manufacturer. Sheetings are selling slowly, but are firmer in undertone. Prints are quiet and doubtless will be until the full affect of curtailment in Fall River is felt. In July, there was a spurt in the demand for prints for Western accounts, and shipments were marked "Rush," so that the general feeling is that Western and Northern interests are very low on stocks.

There has been very little export business except to Manila and Brazil where several large shipments have been made. The Red Sea trade shows no improvement except on light drills and twills, and China and Japan are doing very little with American goods. Exports this year to date are about 20 per cent behind last year at this time. There has been an improvement in the demand for light tickings for South America, according to interests identified with Bliss Fabyan & Co., of Boston. A. C. A. and other popular brands of 8-ounce ticking are selling rather slowly and it would not be a great surprise if there was a price reduction of one-half cent to stimulate demand, both export and domestic. Houses doing an export business do not look for any improvement in the Red Sea trade until definite reports can be secured from the heavy failure of cotton goods interests recently reported in the Orient. A receiver has been appointed and an inventory of goods on hand will soon be publishd.

One of the many distressing developments during July was the speculation in spot cotton which appeared to develop into a corner. Prices were rushed so high that Fall River and Southern mills sold raw cotton at a greater profit than they could make if they manufactured it into yarns and fabrics. A small mill in Fall River had 1,900 bales that was sold at a profit sufficient to pay 3 per cent. on the entire capital stock. Another mill made a net profit of $11,000 by selling a warehouse full of cotton and taking a profit on futures that were purchased some little time ago. Many mills sold cotton for shipment to New York and delivery to speculators, and they will have to pay dearly to hold their organizations together later on when they will be forced into idleness. It is a good bit of financing to take profit on cotton; but the manufacturer will have to pay the toll when his organization becomes scattered to the four points of the compass.

A favorable development was the reception given the new line of 32-inch dress ginghams which have been offered by the leading gingham interests for both the jobbing and cutting-up trade. They are fast colors and in checks, stripes and semi-fancies. Amoskeag 32-inch madras are quoted at 11½ cents for the Beverly brand and 10 cents for the Fairfax brand. Cone Export & Commission Co. are showing a very attractive line of dress ginghams at 12½ cents. These are made at Concord, N. C., and represent the best gingham produced in the South for this trade. H. B. Claflin Co. held a record sale of the dress goods recently taken over from the Tefft-Weller Co., of New York, at 72½ cents of the invoice price in net cash. The value exceeds $1,600,000. This stock of dress goods has been hanging over the market for several months, and it will be a great relief when it is finally moved into consumers hands.

Textile machinery builders are increasing their facilities constantly because of the large number of orders being placed for new machinery and repair parts. During this period of curtailment mills are making necessary repairs and displacing unprofitable machinery with more modern. After a textile machine has outlived its usefulness, that is, cannot compete with new machinery in production and quality, it might just as well be dumped into the scrap heap as to be operated with negative results. Mills equipped with ancient machinery will have pretty stiff competition when all of the many new mills that are being equipped with the latest high speed machinery are in operation. Machinery builders are pointing this fact out to mill men and as a result are getting very busy on orders for replacements. Supply houses have had a very much better month than during June or May. Mills reached a point where they were obliged to buy supplies or shut down. E. H. Jacobs Mfg. Co., Danielson, Conn., manufacturers of lug straps and loom pickers, report nearly double the business in July than in May or June. Belting makers also report improved conditions.

Textile mill shares hold very firm considering the condition of the industry. The break in stocks and bonds listed on the exchanges had little or no effect on mill shares except where it was necessary to sell mill shares to meet margins on listed shares. There were a few forced sales of Amoskeag, Bates and Pepperell in Boston during the last week in July by banking interests that were obliged to protect certain listed securities that they were interested in; but the general public has sold very few textile shares during the month.

PICKING COTTON BY MACHINERY.

On July 19th patents were issued to Crawford Elliott, the inventor of the book typewriter, on a cotton picker or harvester which he has perfected as the result of nearly seven years' constant effort. The basic patent granted covers 40 different claims. The machine has been tested for two years in the cotton fields, and with it one man and a team of mules will do the work of 40 hand pickers. Only the ripe cotton is picked, and this is done without injury to the green cotton or the flowers. It would seem that the successful cotton picker has at last arrived and will enable the planters to greatly increase the present acreage under cultivation.

The principle of the machine involves a double row of bristle brushes about 1½ inches in diameter and 14 inches long, spinning rapidly in such a manner that the revolving brushes are introduced into the plants close to the ground and drawn up in a vertical line through the plants, the brushes penetrating the bushes from both sides of the row. The ripe cotton adheres to the brushes while the rest of the plant is not in any way effected, the brushes traveling to a receptacle where they are stripped of the cotton and the operation is repeated.

It has been thoroughly tested and is said to have demonstrated that it will do the work at a quarter of the cost of hand labor, which means a saving of $150,000,000 a year to the cotton growers. The invention has been purchased by the National Cotton Harvester Co., Chicago, Ill.

MARKET REVIEWS.

MONTHLY REVIEW OF THE COTTON MARKET.

BY H. & B. BEER, NEW ORLEANS.

The unfavorable weather in all sections east of the Mississippi River and Arkansas, made mention of in our letter last month, continued until about July 20th, incessant rains, generally heavy in character, having been the rule. As a result the growing crop is said to have suffered further deterioration in all the South Atlantic and Mississippi Valley States, South Carolina, Georgia, Alabama, Mississippi and East Arkansas suffering most. Of late, however, there has been a change for the better in weather conditions in the central and eastern portions of the cotton region, and farm work is being vigorously pushed. Nevertheless, it is said that the crop, especially in the bottoms, has been so badly hurt that it will require almost perfect weather during the balance of the season to bring the plant back to a normal condition, as the fields are reported overrun with weeds and grass, to such an extent that it is said that some low lands will have to be abandoned.

In the Southwest weather conditions have been more favorable, especially in Oklahoma where the outlook could hardly be more promising. Texas has held up remarkably well, considering claims that the State has not received sufficient moisture this year, especially during the past three months. Until recently the weather in Texas has been generally partly cloudy to cloudy with occasional scattered showers, in some instances moderately heavy beneficial rains, which probably accounts for the plant holding out so well. Except for scattered showers, generally light in character, the weather in Texas during the last of the month was clear and warm, high temperatures having prevailed at many points, and it is said that the hot, dry weather is beginning to have a bad effect on the growing crop. There is probably some ground for complaint of insufficient moisture in Texas thus far this year, as the total average rainfall for the State in June was only 1.90 inches compared with 3.37 inches for the corresponding month last year and 2.48 inches in June of 1908.

In the event of hot, dry weather continuing in Texas and Oklahoma, it is feared that the crops of the Southwest will suffer a set-back, the extent of which can only be measured by how long the threatened drouth might last. On the other hand, if opportune, generous and well distributed rains are had in the near future west of the Mississippi River, it will probably give every assurance for "bumper" crops in Texas and Oklahoma, which, to a certain extent, will offset the unfavorable prospects in the eastern half of the cotton belt. From March 1st to July 1st the total average rainfall in Texas was 9.95 inches against 9.06 inches last year when a very small crop was made, and 14.90 inches in 1908 when a large yield was produced. Therefore, the matter of rainfall becomes a serious question just now insofar as the making of the Texas crop is concerned.

At the opening of the year preparations were made for the making of a 14,000,000 bale crop, but the spring was unseasonably cold, causing replanting on a very large scale. The late replanting was followed by a long spell of wet weather covering two-thirds of the belt; and as the plant was small, it was overtaken by grass, resulting in the present situation. The tendency has been to modify early crop estimates, and while it is too early to dwell on the possibilities of the plant, indications, nevertheless, favor a modification of early crop views.

Current unofficial estimates now range from 12,000,000 to 13,000,000 bales, with the consensus of opinion centering on the probability of a crop of about 12,500,000 bales. Such a yield might and might not be sufficient to meet the world's requirements the coming season. Advocates of higher prices contend that the world will need at least 13,000,000 bales of American cotton next year, while the less pessimistic are of the opinion that a crop of 12,500,000 next season will suffice owing to unfavorable trade conditions in America and because of the already high prices for the raw material. In this connection we might say that new crops at prevailing levels, about 13 cents, are warranted, and it is probable that it will be a hard matter to secure new crop cotton under 14 cents until the movement of new cotton is well under way. Thus far Houston has received 94 new bales, against 2 last year, and 660 in 1908.

STATISTICS.

	1910	1909	1908
Am't. of cotton marketed to July 22	10,235,000	13,473,000	11,299,000
Am't. of cotton unmarketed (est.)	265,000	352,000	280,000
Total commercial crop (est.)	10,500,000	13,825,000	11,578,000
World's visible supply, American	1,038,000	1,974,000	1,307,000
World's visible Supply, foreign	929,000	651,000	814,000
Total world's visible, all kinds	1,967,000	2,625,000	2,121,000
New crop prospects	Unsatisfactory	Poor	Good
Middling cotton, New Orleans, July 23	15c	11 7-8	10 1-2

THE YARN MARKET.

Although price changes for yarns during the past month were about equally divided between advances in some counts and recessions in others as compared with prices of the preceding month, yet it may be said that the technical position of the spinners was improved, due to a number of factors whose influences are felt both directly and indirectly in the yarn market. The most prominent features which tended to strengthen the position of the spinners included short selling of yarns during the early part of the month by dealers, the continued drastic curtailment of yarn mills, the extent of which was estimated near the latter part of the month at from 50 to 65 per cent., the spectacular rise in the price of cotton in the primary market, the slightly improved demand from the knitting trade, and the conviction that the amount of stock yarn on hand was very much smaller than was generally believed. The two factors that tended to work against prices were the necessity of a few mills to move some stock to obtain necessary funds, and the general lack of demand which has been the dominant factor for many months in keeping yarns depressed.

The increased number of inquiries noted at the end of June was continued into July, which resulted in a firmer tone to the market, that is, as far as quotations from spin-

ners were concerned. It may be mentioned, however, that these inquiries did not result in any material increase in the amount of business that was put through owing to the disparity in prices between what the buyers were willing to pay and what the spinners would accept. In view of the fact that the spinners maintained their position of firmness, it is practically a certainty that some transactions during the early part of the month were short sales. Although it was claimed that the drastic curtailment by yarn mills had not had any appreciable effect upon the yarn market, yet it was noticeable that certain counts of yarns were not available, and the range of numbers which were difficult to secure was increased as the month wore on. Such a condition was naturally to be expected and it is by the continued scarcity of yarns required that will give a tremendous impetus to quotations when the first signs of a real active demand appears.

Weaving yarns showed some slight weakness toward the middle of the month which was probably due to the scant demand and to the fact that certain spinners had to move their stocks at that time to obtain the necessary funds for their business. Some sales of stock yarns were reported at concessions which always have a tendency to cause more or less irregularity in the quotations.

Hosiery yarns were in better demand with prices firm, owing to the show of some activity in the knit goods market. The increased number of inquires also brought out the fact that the yarn desired by knitters could not always be obtained from the particular mills which the buyers specified, due to the curtailment schedule in operation. The yarn situation among the hosiery manufacturers presented a rather interesting state of affairs, and many conjectures were made as to the outcome, in view of the fact that the manufacturers were selling their goods on a basis below that of current yarn prices, and as it is understood that they have very little yarn on hand, the question arises as to what method they will pursue to cover their requirements.

Late developments in the cotton market seem to indicate that the average price of the new crop will be considerably higher than was at first anticipated, and fully justify the spinner in maintaining his position of firmness in regard to prices.

Taking into consideration all of the factors affecting the market, it would seem that an early agreement between the spinners and buyers will be made which will serve to bring about the long desired improvement in the yarn market. The reasons for this conclusion are based on the fact that the spinners have the new crop season just before them for which they will need additional funds, and the buyers' stocks are undoubtedly in a very low condition and will need replenishing if they are to do any manufacturing this fall.

New York quotations at the end of July were as follows:

SOUTHERN SINGLE SKEINS

4s to 8s	20 @--	22s	22½@--
10s to 12s	20½@21	26s	23 @23½
14s to 16s	21 @22	30s	23½@24
20s	21½@22		

SOUTHERN TWO-PLY SKEINS.

4s to 8s	20 @21	36s	28½@--
10s to 12s	21 @--	40s	29 @30
14s	21 @21½	50s	34 @35
16s	21½@--	60s	40 @41
20s	21½@22	3-ply 8s upholstery	21½@22
24s	22½@23		
26s	23 @	4-ply 8s upholstery	21½@22
30s	24 @--		

SOUTHERN SINGLE CHAIN

8s to 10s	@20½	22s	22 @22½
12s	20½@21	24s	22½@23
14s	21 @21½	26s	23 @23½
16s	21½@22	30s	24 @24½
20s	22 @22¼	40s	30 @30½

SOUTHERN TWO-PLY CHAIN WARPS.

8s to 10s	21 @21½	26s	23½@24
12s to 14s	21½@22	30s	24 @24½
16s	22 @22½	40s	30 @31
20s	22½@22¾	50s	34½@35
24s	23½@24		

SOUTHERN PEELER FRAME CONES.

10s	21 @--	20s	22 @22½
11s	21 @--	22s	@22½
12s	21 @21½	24s	23 @23¼
14s	21½@--	26s	23½@24
16s	@22	28s	24 @24½
18s	22 @22½	30s	24½@25

THE KNIT GOODS MARKET.

With such an encouraging opening of the spring lines during the latter part of June after a delay of about six weeks, the action of the market during the past month, as far as prices were concerned, was very disappointing, and no reasonable explanation for the recession in prices could be found. The features which stood out the most prominently in the market during the month were the buying by the small jobbers, the anomaly of prices, and the appearance of manufacturers in the market seeking business direct.

After the first rush of the opening, the new season was slow in getting under way, and the amount of business contracted for during the first part of the month was very disappointing. It is true that a number of buyers were in the market, but they were not placing orders as frequently as might have been desired. They also appeared to be rather critical of the goods which naturally resulted in some keen competition for business. Although the hosiery business continued to show improvement over the previous dullness of the past few months, yet the amount of business contracted for for spring delivery was only a small proportion of what will be the total business for the season.

One of the most inexplicable elements in the knit goods market was the low range of prices on hosiery, which, although the styles opened at about 2 1-2 to 5 cents above the prices of last year, they soon dropped back to the last year's figures, and later went 2 1-2 cents below. For example, take the 176 needle, one pound, eight ounces ladies' hosiery which was quoted last year at 67 1-2 cents. This opened at 70 cents, and can now be secured at 65 cents. Again, 144 needle half hose which was sold at an average price of 65 cents last year, during the latter part of the month, sold at 55 cents. Such prices, it can be easily seen, are what might be expected on a basis of 10 cents cotton, but with spot cotton at above 15 cents, and deliveries in the new crop quoted at around 13 cents, it naturally raises the question as to what methods of calculation the mills are using in arriving at the low selling prices of their products.

The reduction in prices seemed to have the effect of keeping the large jobbers out of the market, as they probably expect even lower prices than the figures quoted at the end of the month. However, the small jobbers proved very good buyers, as they were in more or less urgent need of new supplies to fill their shelves which had been pretty well cleaned out. It was the buying by the small jobbers that relieved the market of its recent dullness.

COTTON MANUFACTURING.

LENO CLOTH WEAVING.

Different Divisions of Leno Weaves.—Construction and Arrangement of the Doup Harness.—Movements to Produce the Leno Weave.

(*Contributed exclusively to* Cotton.)

by prof. thomas nelson.

Part I.

During the past year leno weaves in cloths have been made very extensively, in fact, in the cotton goods trade, leno cloths have played a very important part. There are many readers of textile papers who do not know just exactly what leno cloth is; there are others who know what the cloth is, that is, how the leno weaves appear in the fabric, but they do not understand how the effect is obtained. In this series of articles an effort will be made to illustrate as clearly as possible the principle of making lenos.

Leno weaves differ very essentially in principle from the regular or ordinary weaves. The ends in a leno weave do not run at right angles to each other, but certain ends cross over or under other ends, which gives these weaves their peculiar zig zag effect. For the purpose of simplifying the explanation of these weaves we will make three divisions, and call them (1) hemstitch leno, (2) net or lace leno and (3) full turn leno.

Before examining into the methods of obtaining these lenos, different diagrams will be given which can be examined, and being in an enlarged form, the crossing of the thread will perhaps be better understood than if woven samples were shown.

Fig. 1 illustrates one end crossing under one end in three different and distinct effects. In all three effects it will be seen that the end marked D is first woven in on the right hand side of the end marked E, then passes under the left hand side of the end E. In diagram A, only one pick is put in; then end D passes under, and another pick is put in; the end D then passes back to the right hand side, and this is repeated. In diagram B, two picks are put in; then end D makes the change, and two picks are again put in; then the end D passes back to the right hand side to be again repeated. In diagram C, three picks are put in; then the changes are made. It will be noticed that all of the changes are made in exactly the same manner, the only difference being in the number of picks put in before a change is made.

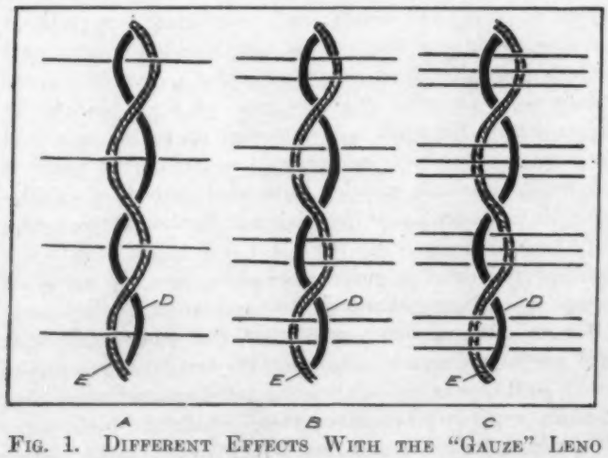
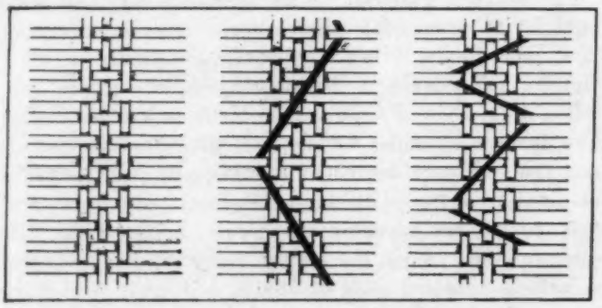


Fig. 1. Different Effects With the "Gauze" Leno Weave.

If the reader will examine some mosquito netting, he will find that the ends work exactly as in diagram A, Fig. 1. Fabrics from this weave are also often called "gauze," and the weave itself is often called the gauze weave. Diagrams B and C are made on exactly the same principle, but are generally used in combination with other weaves in the fabric.

Fig. 2 is a sample of cloth combining the leno weave, diagram C, Fig. 1, with the plain weave and making what is known as a veined stripe.



Figs. 3, 4 and 5. Diagrams to Represent the "Lace" Leno Weave.

The leno weave C is repeated three times in each stripe, and the effect is readily seen in the cloth. Frequently this weave is made with four picks in the change, which gives a slightly more open effect. These examples illustrate the first division known as the hemstitch leno. Other effects are obtained by combining these weaves together, but the principle of making them is the same.

The second division known as the lace leno is illustrated in Figs. 3, 4, 5, 6 and 7. Fig. 3 is simply three ends weaving plain. Fig. 4 illustrates a "crossing" end placed as it were on top of the three plain ends. Fig. 5 illustrates a "crossing" end again placed on top of three plain ends, but giving a different effect from Fig. 4. Fig. 6 illustrates

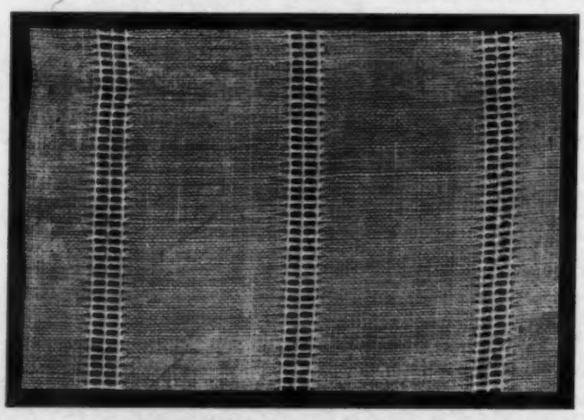
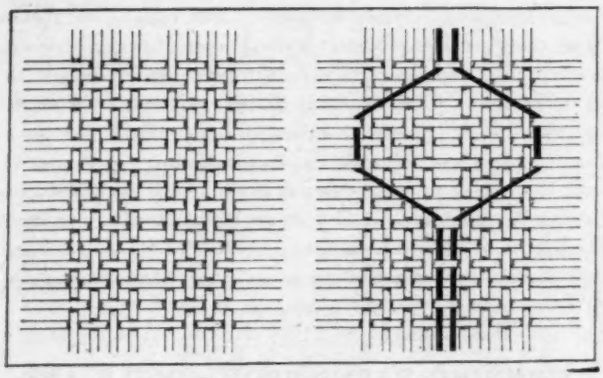


Fig. 2. Sample Showing Leno as a Veined Stripe.



FIGS. 6 AND 7. DIAGRAMS SHOWING PRODUCTION OF DIAMOND EFFECT.

eight ends weaving plain, with a space dividing them into two sets of four ends each. Fig. 7 shows a "crossing" end on each set of the four plain ends. Fig. 8 is a sample of lace leno cloth from which it will readily be seen that Fig. 7 is an enlarged diagram showing the two "crossing" ends forming a diamond effect.

The different effects which can be obtained by this method are practically unlimited, and when the method of making one of these effects is clearly understood, there should be no difficulty in making others.

Fig. 9 is a sketch of two ends of a full turn leno, constituting the third division. It will readily be seen from the diagram how the end marked A makes a complete turn around the end marked B. This is the distinguishing feature of this leno, hence the term, "full turn" leno.

CONSTRUCTION AND ARRANGEMENT OF THE DOUP HARNESS.

The ordinary style of harness shafts and heddles are used to make leno cloths, except for the doup. This heddle, which is of special construction, is illustrated at Fig. 10. Fig. 11 illustrates a doup heddle marked A with a doup B passing through the eyes C and D and tied to the bottom of the doup shaft E. The crossing end F passes through the loop of doup B.

Fig. 12 more clearly illustrates the arrangement of the harnesses, doups, warp beams, etc. Each part has a special name well known to leno weavers, and throughout this discussion these names will be used. It will be noticed that only two ends are shown in the diagram Fig. 12, but the

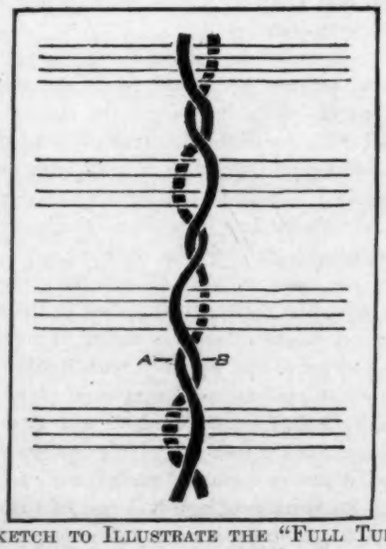


FIG. 9. SKETCH TO ILLUSTRATE THE "FULL TURN" LENO.

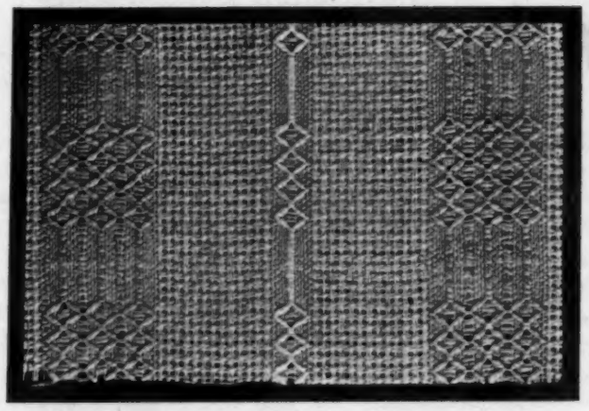


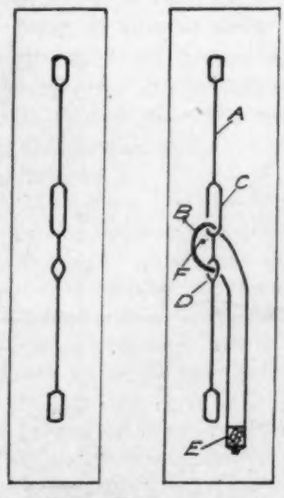
FIG. 8. SAMPLE OF LACE LENO CLOTH.

method of threading them through the different heddles and doup is clearly shown, and is the same for the other threads in the warps. In the illustration A represents the doup; B, the doup harness; C, the crossing harness; D, the standard harness; E, the slackener or easer; F, the crossing end; G, the standard end; H, the main beam; and J the slack beam. These terms will be used throughout the description. The term "crossing" end will always be referred to as the end which actually makes the crossing, and the end or ends which are covered by the crossing end will always be called "standard" ends, though these are sometimes referred to as "ground" ends.

In Fig. 12 it will be noticed there are four harness shafts used; one for the crossing end, one for the standard end, one for the doup heddle, and one for the doup. The doup does not require a heddle as will be seen, and it is this arrangement that enables the crossing to be made.

MOVEMENTS TO PRODUCE THE LENO WEAVE.

A careful examination of all the different examples given will show that there are practically only two movements required to make the changes required in leno weaving, the difference in effect not being obtained by the manner of changing but by the number of picks put in a shed before the change is made. This is illustrated by Fig. 1. In Figs. 4, 5, and 7, three different patterns are made, but all are produced on the same principle of changing the crossing end, first from one side and then to the other, the



FIGS. 10 AND 11. DOUP HEDDLE AND ARRANGEMENT OF DOUP AND HEDDLE.

difference in effect resulting from the number of picks put in the clothh between the changes.

These two changes of the crossing thread are known as the "open" pick and the "crossed" pick. In order to understand thoroughly how these two changes are made, it is very important that the method of drawing the ends through the harness and doup be clearly understood. In the diagram Fig. 12, the harnesses are shown in the position they occupy for the "open" pick. The standard end G comes from the bottom beam H and passes through the heddle on the standard harness D; then over the doup A, which causes the end to work between the doup heddle B and the doup A. The crossing end F passes around the slackener E from the top beam J; then through the heddle on crossing harness C and then through the loop in the doup A.

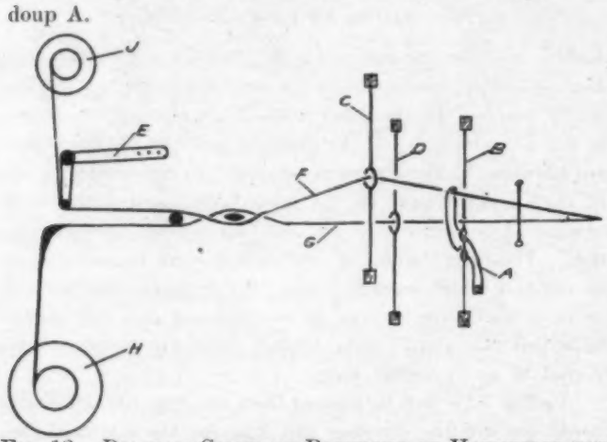


FIG. 12. DIAGRAM SHOWING POSITIONS OF HARNESSES FOR PRODUCING THE "OPEN" PICK.

The following points should be particularly noted: The crossing end F *always* passes through the crossing harness C and the doup A. The crossing harness C and the doup A are *always* raised for the open pick.

Fig. 13 illustrates the same harnesses used as in Fig. 12, but shows the different positions of the harnesses for producing the second movement for the crossed pick. It will be noticed that neither the crossing harness C nor the standard harness D has been raised; only the doup harness B and the doup A, and slackener E are raised. This, as will be seen, brings the crossing end F from one side of the standard end G to the other side. In this connection the following points should be carefully noted: The doup and doup harness and slackener are *always* raised for the crossed pick. The crossing harness is *always* left down. When only one standard harness is used, as in Fig. 13, it is *always* left down on crossed picks. The reason for this is that the crossing end has passed under the standard end from the left to the right side by raising the doup and the doup harness. If the crossing harness should also be raised, the crossing end would be raised on both sides of the standard end and would break the standard end. If the standard harness is raised, both the crossing and standard ends would be raised and no shed would be made. It is absolutely necessary to raise the slackener because of the extra length of crossing end required to pass under standard end.

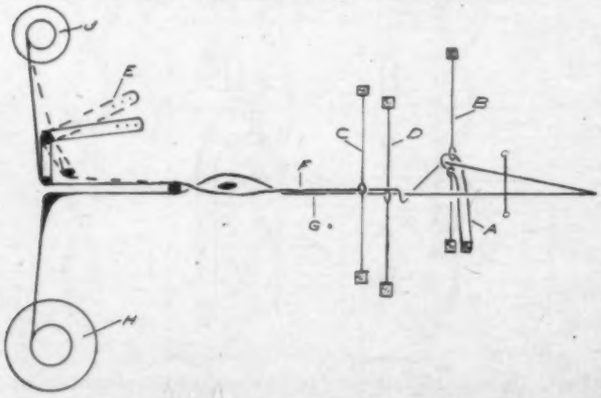


FIG. 13. DIAGRAM SHOWING POSITIONS OF HARNESSES FOR PRODUCING THE "CROSSED" PICK.

(To be continued.)

SPINNING YARNS FROM SINGLE AND DOUBLE ROVING.

THE ESSENTIALS OF YARNS—ADVISABILITY OF USING SINGLE AND DOUBLE ROVING—EXAMPLE OF SAVING IN COST BY USING SINGLE ROVING.

(Contributed exclusively to COTTON.)

BY H. C. W.

The qualities most to be desired in any cotton yarn are evenness in weight and color in the strand or thread itself. Another quality aimed for is cleanliness and the absence of neps and motes. A further desirable quality is its appearance in regards to luster. Another important quality is its strength which is made variable, being dependent upon the purpose for which it is to be used.

The evenness of any yarn is dependent upon the number of doublings used in its manufacture, the amount of draft, and the number of processes used. The care with which stock is handled by the operatives during manufacturing is also a factor which enters into the evenness of a yarn. The cleanliness and luster are dependent upon the efficiency of the picking, carding, and combing operations. The strength of a yarn is dependent upon the strength of the fibers themselves, the number of processes used, the twist per inch and the way in which it is handled.

Quality is often sacrificed to economy in the cost of production—the more processes used in making a certain number of yarn, the higher the cost. As the roving from which a yarn is spun has to be made finer, more processes are required, and more fly frame spindles are required to keep up the production.

Mills of to-day must be run with every possible economy as competition is very keen, and goods are sold on small margins of profit. This has led to the spinning of yarns from single roving for certain ranges of numbers of yarns which are not required to be of a very high quality. Almost all mill men will agree that a more even yarn can be spun from double roving than from single roving. The evening qualities are obtained by doubling.

Provided the same number of processes are used preliminary to spinning, double roving used in the creel of the spinning frame will increase the number of total doublings obtained to just twice that obtained with single roving. To illustrate this: Suppose three processes of picking are used. This will give 16 doublings. Carding will give a doubling of one, still making the total 16. If two processes of drawing are used, doubling 6 ends at each frame, a total of 576 is obtained. Slubbers double only 1 end of drawing giving a total of 576. Intermediates and fine fly frames double two ends at each frame, giving a total of 2304 doublings

for the roving. Now if single roving is used in the creel of the spinning frame, the total doublings used in the manufacture of the yarn will be 2304. If double roving is used, the total will be just twice this amount or 4608 doublings.

Yarns, such as are used in cotton blankets, canton flannels, and other napped goods where the identity of the yarn itself is lost, due to the nap, may be spun from single roving. Print cloth yarns are also spun from single roving. This class of goods is usually colored and filled, and the design is made the predominant feature rather than the cloth itself. Coarse numbers of hosiery yarns, going into cheap grades of hose, half-hose, and underwear are also spun from single roving.

The range of numbers which it would be advisable to spin from single roving would run as high as No. 36s. It is possible to go beyond this limit, but the quality of the yarn spun will suffer as a consequence. An average range of drafts on the spinning frame is from 6 to 9. When using double roving, it is possible to increase the draft to from 9 to 12 and sometimes on fine numbers to as high as 14, and still spin a yarn of higher quality than with single roving. This is due to the extra doublings obtained.

A good example of this superior spinning can be shown in the case of a mill which spun No. 17s filling from No. 2 hank single roving, using a draft of 8.5. They wished to increase the quality of the yarn and still not effect the production of the card room in any way. This was done in the following way: The No. 2 hank roving was doubled in the creel of the spinning frame, and the draft doubled also. The spinning frame still produced the same number of pounds and still consumed the same amount of No. 2 hank roving. This filling was used in a heavy grade of narrow cotton sheeting and the appearance and quality of the cloth were greatly improved.

In weaving yarns ranging from No. 40s upward, quality must be the first consideration. Poor cloth cannot but result from a low grade yarn. Doublings increase the evenness and strength of yarn. The theory is that two or more laps, slivers, or strands of roving, if made from the same stock under the same processes and conditions, will both be of a like nature in regards to evenness. If doubled, the light and heavy places of one are offset by the heavy and light places of the other, giving a lap, sliver, or strand of roving which is more even and which represents the average of the strands doubled. It is obvious that the more doublings used, the more even the strand of yarn will be. A stronger, smoother, and more lustrous yarn is obtained from double roving, because while the individual fibers of each strand are twisted around each other, the strands themselves are twisted.

The great advantage that single roving possesses over double roving is the difference in cost, both in the equipment required and in the manufacturing itself. To illustrate this difference in cost, suppose two mills are spinning print cloth yarns of the following counts: No. 28s warp and 36s filling for a standard grade of print cloth. The production of yarns is 25,000 pounds a week of warp and 20,000 pounds of filling. One mill spins from single roving and the other from double roving. The mill spinning from single roving uses a No. 4 hank fine roving in the creel, and the following program is used during the process of manufacture:

The No. 4 hank fine roving is used for both warp and filling; and for 28's warp a draft of 7 is required. For 36's filling a draft of 9 is used. The following list of sizes of roving, weights of slivers and laps will suffice for making both warp and filling:

Hank on fine frame roving	4.00	
Draft on fine frame	5.00	
Hank on intermediate roving	1.60	
Draft on intermediate	5.33	
Hank on slubber roving	.60	
Draft on slubber	4.31	
Weight per yard of finished drawing	60.	grains.
Draft on finished drawing (doubling 6)	6.00	
Weight per yard of breaker drawing	60.	grains.
Draft on breaker drawing (doubling 6)	6.00	
Weight of card sliver	60.	grains.
Draft on card	97.00	
Weight of finisher lap (5 per cent. waste)	14.00	ounces.

This program gives only the one size of roving, weight of slivers and laps, thus reducing the process of manufacture to its most simple form.

In the mill using double roving the following sizes of roving, weights of slivers and laps which will be found to be different in some processes for warp and filling:

NO. 28'S WARP FROM DOUBLE ROVING.

Draft on spinning frame	11.2	
Hank on fine roving frame	5.00	
Draft on fine frame	6.00	
Hank on intermediate roving	1.66	
Draft on intermediate frame	5.00	
Hank on slubber roving	.66	
Draft on slubber	4.75	
Weight of finished drawing	60.00	grains.
Draft on drawing frame (doubling 6)	6.00	
Weight of breaker drawing	60.00	grains.
Draft on breaker drawing frame (doubling 6)	6.00	
Weight of card sliver	60.00	grains.
Draft on card	97.00	
Weight of finished lap (5 per cent. waste)	14.00	ounces.

NO. 36'S FILLING FROM DOUBLE ROVING.

Draft on spinning frame	12.00
Hank on fine roving frame	6.00
Draft on fine frame	6.00
Hank on intermediate roving	2.00
Draft on intermediate	6.06
Hank on slubber	.66

By examining the layout for 28's warp and 36's filling in the mill using double roving, it is seen that the same hank of slubber roving is used in both numbers of yarn, and the weights of the drawing, card sliver and laps, as well as the drafts, are the same.

A comparison of the lay outs used in the two mills will show that the picking, carding, and drawing processes both produce the same weights of laps and slivers with the same drafts. Therefore the number of these machines required to produce 25,000 pounds of warp and 20,000 pounds of filling in the process mentioned, will be the same, and the cost for equipment will be the same for both mills for these processes.

Both mills produce 25,000 pounds of warp and 20,000 pounds of filling, and the counts are the same in both mills. Therefore, the same number of spinning spindles will be required in both mills and the cost of equipment will be practically the same for the spinning operation.

A comparison of the costs of installing the machinery for carding will show quite a difference. In the case of the mill using single roving where both warp and filling are spun from No. 4 hank fine frame roving, 3,246 fine frame spindles will be required to produce 45,000 pounds of No. 4.00 hank roving per week, making no allowance for waste.

The mill using double roving, and spinning the warp from No. 5 hank fine roving and the filling from No. 6. hank fine roving, will require 2,350 fine frame spindles to produce 25,000 pounds of No. 5 hank for the warp, and 2,410 fine frame spindles to produce 20,000 pounds of No. 6 hank roving. This means that a total of 4,760 fine frame spindles will be required to produce roving for this mill, which is an increase of 1,514 spindles over the number required for the mill using single roving. Carrying out this same idea in the preceding processes, it will be found that 200 more intermediate spindles and 40 more slubber spindles will be required.

As the weights of the drawing, card sliver and laps are alike for both numbers in both mills, the number and cost of machines will be the same in both mills. In addition to the extra machines required there is the cost of the extra floor space in which to place them. More belting, shafting, hangers and pulleys are required to drive them. The cost of repairs is greater. The value of the plant is more, and therefore a greater share of the profits will have to be laid aside as a depreciation fund.

The second item is that of manufacturing costs. Because a larger equipment is required for the mill using double roving, more help is required, and the cost per pound is increased. This item of manufacturing cost is one which is continuous, and undoubtedly puts the mill spinning from double roving at a disadvantage. If both mills sold their cloth or yarn at the same price, the mill using single roving would be able to pay a higher rate of dividend than the other mill. If they both sold with the same margin of profit, the mill running on single roving would realize a larger amount on the investment and still be able to undersell its competitor.

Summing the matter up and taking into consideration all things which influence the grade, quality and cost of a yarn; the only advantage spinning from single roving possesses over spinning from double roving is the difference in the cost which would, up to a certain limit, in some cases, be the one great advantage.

ALUMINIUM YARN AND CLOTH.

Though aluminium takes first rank among metals for lightness combined with toughness and durability, it is hardly what one would expect to prove useful as a textile material, but the articles now made from it include neckcloths, pompadours, shoes, belts, neckties, shawls and hats. Straps and lacing for shoes are among the newest productions. Sieves or screens from aluminium have proven especially valuable in sugar refining, as it quickly becomes coated with acid-resisting oxide; and it can be woven alone into fabric for other purposes. The best results, however, are obtained by employing the aluminium yarn—smooth or twisted—as warp, with colored silk threads for filling. When this cloth is made into cloaks or theatrical costumes, the effect is very striking, and the body of a woman is said to look as though dipped in silver. Fabrics and clothes from glass and silk threads woven together attracted much attention when exhibited in Paris some years ago.

BLACK OILY THREADS IN CLOTH.

(Contributed exclusively to COTTON.)

BY R. HANNAN.

This trouble of oily threads in cloth is a source of great annoyance and loss to the majority of weaving managers of today, and one may rightly term these objectionable threads a pest to the trade. I have seen instances just recently of rejected cloth that was in every way commercially good save the presence of these oily threads which deteriorated its marketable value. It is hardly necessary to explain to men who see this cloth woven what trouble these oil stains make, as these oily threads show themselves in the cloth sometimes in the warp and sometimes in the filling. And often weavers are negligent in checking the evil until it has gone too far. The result is that a thin black line can be seen all along the cloth and so bad is it in many instances that any attempt to remove it would make the cloth entirely unfit for sale. It, therefore, has to be consigned as seconds, which naturally means a loss to the seller. A sample of cloth containing black oily threads is shown in Fig. 1.

When weaving managers make their complaints to the seller of the yarn, the consolation that he generally gets is that he the seller does not hold himself responsible for the failings of the workpeople who have allowed this yarn to be made into cloth without its being detected. Yet when one comes to consider it, the spinner is the one who should bear the loss, for it is in the various stages of yarn production that led to the cloth being spoiled. In almost every case of oily yarn the cause can be traced to the bobbin that held the roving, and this oily yarn is generally made when the roving is nearing the bare bobbin as shown in Fig. 2.

When a bobbin has been in use for a number of years it will be found that the end commences to crack, due to the rough treatment to which it has been subjected. These cracks also get oil into them through the fact of their having been thrown about the floor. Oil is also soaked into the bobbin from dirty bolsters of the roving frame, but very often the chief cause is from the spinning room floor which is generally quite oily.

When the bobbin is placed on a spindle of the roving frame and the roving is being wound around it, the oil gradually oozes out of the cracks, owing to the gentle tightening process to which the bobbin is being subjected, and

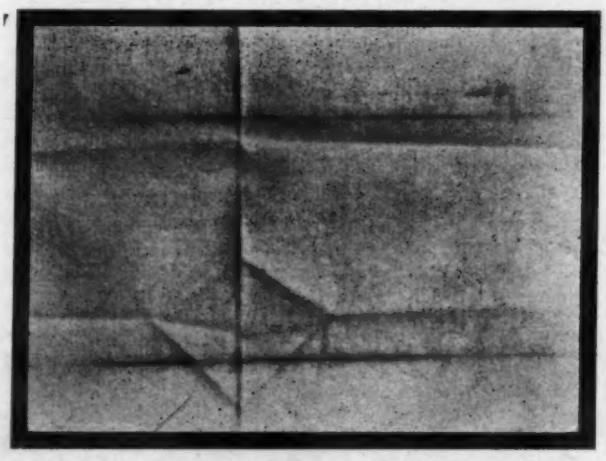


FIG. 1. CLOTH SAMPLE, SHOWING BLACK OILY THREADS.

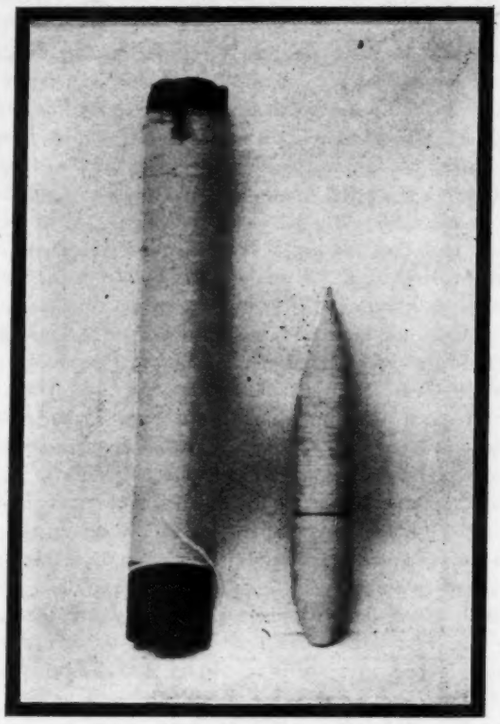


FIG. 2. SAMPLES SHOWING OIL STAINS ON ROVING AND YARN.

so permeates the roving, discoloring it for about a quarter or half an inch down the bobbin for perhaps three or four layers of roving. The same can be said of bobbins that are used to feed to the roving frames, but the blackened roving is oftimes detected through its thickened character. When this is so, the bobbins should at once be taken out of the creel, placed to one side and shown to the overseer in charge who, if he be wise, will order their destruction.

Some mills have a general clearance of this class of bobbins at certain intervals, whilst at many mills the operatives have orders to break any bobbins which they might consider unfit to use. Of course it is the wisest plan for the overseer to use his discretion in this matter, as many of the younger workpeople who are unexperienced might make it very costly for the mill by turning this into a wasteful practice.

Workers on the roving frames should also see that the bolster frames be wiped clear of oil before putting on the empty bobbins in readiness for doffing. Any cracked bobbins discovered should be placed to one side. When the empty bobbins are not in use they should always be placed in the skips or boxes and not allowed to be thrown about the floor.

Oily yarn is sometimes caused through putting too much oil on the saddles of the leather rollers and allowing the oil to get on the leathers; also putting in the stands more oil than is necessary, causing this over supply to run on to the iron rollers. The yarn in turn will naturally take up some of the oil as it passes between the rollers. When yarn is discolored in this way it is generally yellow or brown and not black as is the case when it is discolored from oil on the bobbin.

It is little things like these that many times turn out to be a source of great loss and much unpleasantness to the management of both spinning and weaving.

If firms are to be successful at all during times of trade depressions it behooves every operative to assist in putting on the market yarns which will make a good name for the firm.

DESIGNING AND CLOTH ANALYSIS.

BY CHARLES E. BARNHARDT.
(*Contributed exclusively to* COTTON.)

PART IV.

One of the most important duties of the designer or boss weaver, as the case may be, is that of reproducing cloth from a small sample, to be the same weave, texture and weight per yard. The sample furnished is very often not larger than one or two square inches. From this sample must be ascertained (1) the weight per yard of the finished cloth; (2) the number of threads per inch in the warp and filling; (3) the numbers of yarn to be used for the warp and filling; (4) the reed to be used and the width that the warp must be drawn in the reed in order to make the cloth the desired width when finished; (5) the number of picks per inch which the loom must put in when weaving; and (6) the weave from which the drawing in and chain drafts are made.

There are different ways of finding the weight or the number of yards in one pound of a certain piece of cloth. If a yard, a half yard or even a quarter of a yard of the entire width of the fabric in question can be obtained, the weight of a yard of the cloth can be easily arrived at from the weight of a piece this size. However, it is very seldom that even a quarter of a yard of the cloth is furnished for the sample, and generally only a few square inches are available from which to obtain all of the necessary data. The easiest method of determining the weight of a yard of cloth from a small sample is to cut the sample so that it will contain as many square inches as possible without fractional parts. If it can be cut 3×3 inches, it will contain 9 square inches. The larger size it may be, the more accurate will be the result of the weighing.

To find the weight per yard from a small sample; *divide the number of square inches contained in the sample into the number of square inches in one yard of the cloth, which will depend on its width. Multiply the result thus obtained by the weight in grains of the sample, and then divide this product by 437 1/2. The result will be the number of ounces in one yard of the cloth. Then divide the weight in ounces of one yard into 16, which is the number of ounces in a pound, and the result will be the number of yards to the pound.*

The number of warp and filling threads in one inch in a piece of cloth is technically known as the count or so many "sley." Regular print cloth contains 64 ends and 64 picks in one inch, and is usually expressed thus, 64×64, or sometimes as 64 square. When the word "square" is used, it signifies that the same number of threads are used in the same space in both warp and filling. When the counts of a piece of cloth are expressed in figures, the number of the warp threads per inch is written first, followed by the sign for multiplication, after which the number of picks per inch is given. For example, if a piece of cloth contains 64 warp threads and 48 picks per inch, it is usually expressed 64×48. Ordinarily the sley of a

piece of cloth is obtained by counting the threads with the use of a pick glass, but in counting the texture of a fabric of fine construction the most accurate way is to cut a piece of the cloth one or two inches square and pull the threads out one by one and count them.

It is a rather difficult matter to determine the counts of yarn used in the construction of a piece of cloth when a sample consisting of only a few square inches is available. A sufficient number of the threads should be pulled from the sample to form a convenient length, such as 120 inches, and these carefully weighed and the number of yarn calculated from this result. This, however, is a very tedious operation and will not always give an accurate result on account of the bend in the threads caused by their interlacing with each other. It is also hard to find the exact length of each thread, as a slight variation in length will cause a considerable difference in the calculation. This method is also objectionable for the fact that in many instances it is desired to preserve the original sample as far as possible; pulling the threads out to weigh them would destroy a large portion of the sample. A very good plan is to have a collection of small samples of yarn of known numbers, and compare the threads of the sample in question with the samples of the known numbers. It is best to use a magnifying or pick glass in making this comparison, and with a little practice a person can decide quite accurately the numbers of the yarns used in the sample. At any rate an approximate idea can be obtained of the numbers of the warp and filling and a calculation made to determine what weight cloth these numbers would produce. If the calculation shows that the figured yarns are too heavy, finer counts may be used, or if too light, then coarser numbers must be used.

The number of warp threads per inch in the cloth is governed by the reed used. In a plain or ground weave of any kind, the threads are usually drawn in the reed two ends in a dent. Thus, in a 32-dent reed, with two ends drawn in a dent there will be 64 ends in one inch of the reed. However, when the cloth is taken from the loom, it will count more than 64 ends in an inch. This is caused by the contraction of its width in weaving. The amount of contraction depends on the number of threads per inch in the reed. As a rule, the more threads that are used, the less contraction there will be; and fewer threads used will cause more contraction. If we want a fabric to count 64 ends in an inch when woven, and measure 27 inches wide, we would use a 30-dent reed with the threads reeded two ends in a dent, and have the width of the warp in the reed about 28¾ inches.

In producing fancy effects, such as a satin stripe on a plain weave ground, the ground part of the warp is reeded two ends in a dent, while the satin part is reeded 4 ends in a dent. This will cause the satin strips to show up very prominently in the cloth, on account of there being twice as many ends in an inch in the stripe as there are in the ground part. Reeds are usually spoken of as so many dent, signifying so many dents to an inch. Thus, a 30-dent reed means there are 30 dents to an inch. However, they are also quite frequently referred to as so many dents in a given number of inches. For example, a 1,200-reed is one frequently used, and if the reed measures 36 inches in length, it will have 33⅓ dents in an inch. Again it might be a 1,200-reed on 30 inches, which would indicate 40 dents in an inch. When reeds are spoken of in this manner, it is never based on any certain length, and therefore the length of the reed has to be known before the number of dents in an inch can be ascertained.

The next point to be considered is the weave, from which to get the drawing in draft and harness chain draft necessary to produce the design or weave of the fabric. This is accomplished by "picking out" the sample, which process consists of picking out one pick of the filling at a time and designating on the design paper the manner in which it interlaces with the warp.

One point that has to be decided on before the picking out process begins is that of determining which is the warp and which is filling in the sample. Ordinarily this is easy to determine, but in some cases it will require some studying. A few suggestions along this line will probably prove of value: Warp threads almost always have more twist than filling; if the sample shows a part of the selvage, it is known that the selvage always runs in the direction of the warp; if it can be ascertained which system of threads are sized, then the sized threads are the warp; if one system of the yarn is single and the other ply, the ply yarn is the warp; and if there is a stripe in the pattern, either in color or in the weave, the stripe will almost invariably run in the direction of the warp. By holding the sample up to the light, reed marks can often be discerned, which will enable one to readily see which is the warp, as the reed marks always run warp ways.

The use of design paper and the method of making the drawing in and chain drafts from a design have been thoroughly explained in a previous section of this article. The only point necessary to explain is that of copying the weave or design from the cloth on to the design paper. As mentioned above, this is done by what is called picking out the sample. In picking out a sample it is necessary that we have at least one whole repeat of the pattern in the sample of the cloth, and it is best that there be two or three complete repeats, as this will enable the designer to discover any misweaves or mispicks, which are frequently found. Ordinarily the filling is picked out from the warp threads. Before commencing to pick out it is best to pull out several filling threads so as to leave the ends of the warp as a fringe projecting about ⅛ to ¼ of an inch from the first pick which is to be put down on the paper. This will eliminate the danger of making a mistake at the beginning of the pick out. A sharp pointed needle should be used to pull the threads apart, and a pick glass will enable the person to more readily see the manner in which the threads are interlaced. Place the glass over the sample, and when picking out the filling begin with the first pick at the upper left hand corner of the sample; look at the first and each successive warp thread and designate on the design paper whether it is over or under the pick of filling. If the warp is over the filling, a cross mark is put on the square of the design paper, and if the warp is under the filling the square is left blank. On the design paper the cross marks or filled in squares represent risers or warp over filling, and the empty squares represent sinkers or warp under filling. The use of the picking out needle will enable one to easily move the threads apart and assist in keeping the place of the thread under consideration. Consider and designate on the paper the interlacing of each warp thread in succession with the filling just as it is in the sample, until the pattern begins to repeat itself. Then remove this pick of filling and examine the interlacings of the next pick, indicating the interlacings in the same manner on the design

paper as for the preceding pick, but on the line below the first one on the paper. Continue this operation until you have picked out a complete repeat, filling ways, of the cloth. Then you have the design from which the chain and drawing-in drafts are made in the manner previously explained. A point which must be closely watched is to see that each filling thread picked out, begins on the same warp thread, so that they will appear on the design paper in the same relative position that they occupy in the cloth.

On account of the nature of some weaves, it is sometimes easier to pick the warp out of the filling than to pick the filling out of the warp. When picking out the warp, the interlacings are noted on the vertical lines of the design paper instead of on the horizontal lines. It is seldom ever necessary for an experienced designer to pick out a complete repeat of a pattern to ascertain the weave, as experience will teach him to recognize the weave by a careful examination of the sample. It is only necessary for him to count the number of threads in the different effects in order to get the proper size of the pattern. He understands the fundamental weaves, which have been explained in this series of articles, and he knows the proper construction of any weave or combination of weaves. However, it is sometimes necessary for him to pick out part of the sample to see just how the weaves are formed or combined, as the case may be.

In order that the work may run to the best advantage it is necessary in a great many patterns that the warp be placed on two or more separate beams. This is generally necessary in cases where different weaves are used in one repeat of the pattern, in some of which the warp does not interlace with the filling as often as in others. It will be readily understood that a warp thread which interlaces with the filling only once in every five or six picks will not take up as much as one which interlaces at every pick. For instance, if it is desired to weave a piece of cloth with a plain weave for the ground and the 8-harness satin for a stripe effect, the warp for the plain weave would be put on one beam and that for the satin stripe on another beam.

If any ply yarn is used in the warp, it should always be placed on a separate beam, regardless of what its weave may be, for the fact that on account of its being coarser and stronger, it will always run slacker than the single ground warp.

(*To be continued.*)

WOOL MANUFACTURING.

SKIN WOOLS.

VARIETIES OF WOOLS—DESCRIPTION OF SKIN WOOL—DIFFERENT CLASSES OF SKIN WOOLS—REMOVING THE WOOL BY THE LIME PROCESS.

(*Contributed exclusively to* COTTON.)

BY HOWARD PRIESTMAN.

Forty years ago the wools which were sold in London were divided into three descriptions. This classification had nothing to do with their fineness or length of fiber, but related solely to the condition in which they were exposed for sale viz.: (1) Washed fleece, (2) greasy, and (3) scoured and slipe.

Greasy wool still comes to the sale room in the condition in which it originally grew on the sheep's back. "Washed fleece" is wool which is washed in cold water without soap, on the sheep's back prior to clipping. The sand and dirt are largely removed, together with a little of the superfluous grease, but all the internal constituents of the wool are left where nature put them. The wool though so light as to give very good results, as regards cost, is as supple and soft as the best greasy wool could be. For some types of cloth it even surpasses the greasy in finish or fullness; but the growers unfortunately found that the relative saving of cost in transit and the slightly advanced price did not repay them for the cost of washing and loss of weight; and so the practice of "spout" washing has steadily declined until, at the present day, there is practically no imported washed wool on the market.

SCOURED WOOL.

For present purposes, wool may still be divided into three classes, namely, greasy, scoured and skin, the latter being the term which is used to describe all wools which are taken from sheep skins after death. Scoured wool as understood in Bradford, England, is greasy fleece wool clipped from the living sheep in the Colony, but washed there prior to packing, in order to reduce the cost of transportation. Some of the heaviest greasy fleeces grown in Australia contain as much as 66 per cent. of grease, suint, sand and grease when taken from the sheep's back; and as the grower does not wish to pay the freight on three pounds of grease and wool for every pound of wool that is exported, he washes the fleeces before they are packed for shipment. Where the wool is sent down from the sheep station to the coast by water, the cost of transportation is relatively light, and the wool may not be washed until it reaches the coast. But it is quite different in the case of many of the Queensland clips, which have to travel hundreds of miles by bullock wagon before they reach the coast. It is under such circumstances that scouring saves the greatest amount of money.

Unfortunately on some stations sufficient care is not taken as to the nature of the alkali and soap used, and of the temperature of the water in the scouring bowls. For this reason not only are the external grease and dirt removed, but frequently a portion of the internal lubricant, which is known as suint, is removed as well. The fiber is then apt to lack the softness and suppleness of pure greasy, and to bear a certain resemblance to the better class of skin wools, which like hard scoured wool, have parted with some of their internal suint or yolk.

Scoured and greasy fleece wools taken together form something like 90 per cent. of the total offered for sale at the London Colonial auctions; but if the wool that comes from other countries were taken into account, the proportion would not be quite so large. For example, the amount that comes direct from South America in the "fleece" is much less, and the amount of skin wool is proportionately larger. This may not be true of wool that comes direct to England from countries where it is grown, but immense numbers of sheep skins go to Continental centers such as Mazamet. Skins also come from England from all parts

FIG. 1. SECTION OF SKIN, SHOWING FORMATION OF CELLS IN THE HAIR BULB GLANDS AND EPIDERMAL LINING MAGNIFIED 240 TIMES.

of the world with the wool still on them. These skins, together with those of sheep which are killed at home, add very largely to the total and keep the fellmongers busy. This trade in skins has greatly increased since the establishment of the trade in frozen mutton, because it is now possible for growers to dispose of practically an unlimited number of carcasses. It is a branch of the wool trade that is still on the increase, and a trade in which there are endless possibilities and it is certainly one which deserves much more scientific attention and intelligent criticism than it has received as yet. Hence, it is the purpose of these articles to deal with the subject of skin wool in all its phases.

OBJECTIONS TO SKIN WOOL.

It would be absurd to deny that skin wool has a very poor reputation in almost every branch of the textile trade, and it need not be denied that some of this class of wool fully deserves all that is said against it. But it is also true that good and bad qualities suffer together as to reputation, because of the ignorance that exists among users, as to the various methods which are employed to remove wool from dead skins. It is one more sign that specialization may be carried too far, and that ignorance of previous processes is a handicap to a manager in any particular branch of the trade. In this case there can be little doubt that many skin wools are suffering, unjustly for the evil reputation of the worst types.

For some obscure and indefinite reason, all skin wools seem to be regarded as being equally inferior; the general idea apparently being that wool which has been left on the skin of a sheep after death, is in itself dead, or at least affected in some obscure way by the death of the animal on which it is found. As a matter of fact there is not the least ground for such a belief; for wool and hair partake so much of the nature of parasitic growth that hair continues to grow for a time after the death of the man or animal of which it appears to form a part. As against this well accepted fact, no one has ever brought a particle of proof to show that wool clipped from the skin of a dead sheep will differ in the very least from wool taken from the same sheep while alive.

Skin wool is less supple and less lustrous than greasy wool,—not because it has existed for a space of time on the skin of a dead sheep—but because the very drastic methods which are nearly always adopted to remove it from the skin are bound to take away a part of its elasticity or "nature." Different methods affect the wool in different ways. Tanners know how differently they can affect the hides by different treatment, and as hide and wool are very much alike in structure, the user of wool may learn a great deal from the user of the hide.

CLASSES OF SKIN WOOL.

An outline knowledge of the fellmongering trade should be of immense value to the buyer of skin wool, because a scientific knowledge of the processes through which wools pass will enable him to treat each class according to its needs. For this purpose skin wools must be divided into three great classes:

1. SLIPE, a term which is here taken to refer to all wool which is removed from dead skins by means of lime.
2. SWEATER WOOL, which has been loosened by hanging moist skins in a closed chamber until putrefaction or bacterial action loosens the fiber.
3. Wool, which is detached by the use of other chemical re-agents—most often sulphide of sodium.

It is quite safe to say that all the processes are not equally injurious to the spinning value of the fiber, and equally safe to add that the bad reputation of all skin wool is largely due to the wide use of the lime process in England; for until 1903 it was practically universal in English skin yards. The chemistry of the subject is very complicated, but every reader ought to remember that wool and skin contain almost exactly the same proportions of carbon, hydrogen, nitrogen, oxygen and sulphur. It should also be remembered that horn, feathers, and quills all have a very similar composition. All are albumenoid or proteid substances. They belong, in chemical parlance, to the aromatic series, but everything else about them is obscure, except their extreme complexity.

Exactly how they differ from one another is not clear. But they do differ, because there is at least one re-agent that will improve the nature of a skin at the same time that it will reduce wool to a formless pulp. One other fact is well known, and must never be forgotten; the epidermis or cuticle is more allied to the wool than it is to the corium or true skin, and therefore the thin cuticle usually comes away with the wool when the fibers are loosened and removed by depilation.

1. The reason for this is because the action takes place in the soft or living portion of the cuticle which attaches the harder outer layer to the corium, and because the cuticle lines all the pores or sheaths in which the hairs grow. An examination of the root ends of a few fibers that have been loosened by the sulphide process will quickly make this clear. The sheath will be seen surrounding the base of the hair for a length of one hundredth part of an inch, but the soft bulb will be missing, having been destroyed by the action of the alkali.

2. It is the opinion of the highest authorities that the lime process is so general in England for a truly English

reason. Lime is so little soluble in water that it is impossible for a careless workman to make a solution that wil ruin a lot of skins—as would be the case if sodium sulphide were carelessly used. This is surely a poor excuse for adhering to a method which reduces the value of the wool and which will also injure the leather if the limes are allowed to become stale. It is well known that while lime loosens the wool by dissolving the epidermis, it also dissolves the gelatinous or membranous matter in the hide and for this reason lime treatment inevitably causes loss of weight and substance in both wool and skin, and it leaves the wool dry and less supple, because of the action of the lime on the cementing matter within the fiber. In the hide this action is counteracted by swelling in the tanning processes, but there is no known method of doing anything to the wool which will completely restore its elasticity and nature.

All fatty matter both within and outside of the fiber is converted into lime-soaps, and because lime is a more powerful alkali than either sodium or potassium, these lime-soaps are unaffected by subsequent washing with any soap or alkali. This is the reason why all slipe wool, whether free from lime or not, is so terribly difficult to wash. The lime which was used to strip it from the skins may all have been washed out of the wool before it was dried—as a matter of fact, it is most unlikely that the free lime will all be gone—but it is certain that the lime in combination with the suint and yolk will be still on and in the fiber. It is equally certain that nothing but acid or some strong solvent like benzine will remove it.

THE LIME PROCESS.

Now it is an unfortunate fact that wools are still allowed to come on to the market containing not only lime compounds, but free lime in powder or in actual lumps. Presumably he thinks that he will be paid for more weight if the lime is allowed to remain in the wool; but in that case he entirely forgets that the buyer will pay a relatively

FIG. 2. SECTION OF SKIN, SHOWING THE CUTICLE LINING, THE HAIR SHEATHS, HAIR BULBS AND GLANDS THAT SUPPLY WOOL FAT, ETC., MAGNIFIED 120 TIMES.

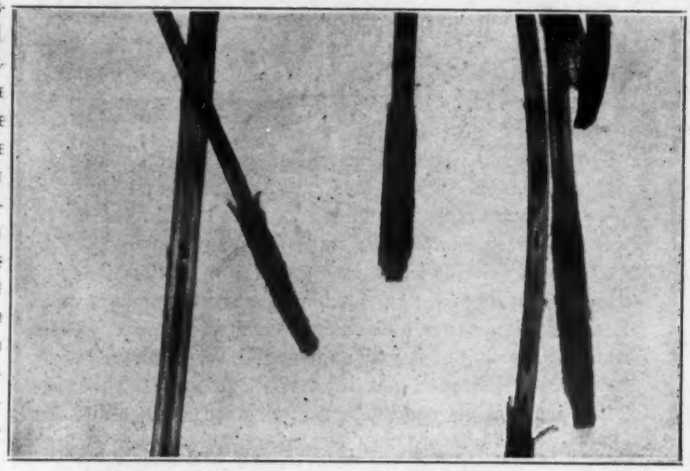


FIG. 3. WOOL FIBERS THAT HAVE BEEN REMOVED FROM THE SKIN BY THE SULPHIDE PROCESS, MAGNIFIED 60 TIMES.

lower price per pound for wool and lime together, than he would for wool without the lime.

There is also the probability of further loss to the seller, because a user will base his calculations on a lower estimate of value for such clean wool as he estimates the bale will contain, knowing that the cost of washing will be excessive and the resulting top will most likely be harsher and of poorer spinning power than one in which there were no lime compounds. Now it is clear to those familiar with fellmongering, that the presence of free lime can be avoided; for the milk of lime or solution of lime in which the skins are steeped need never be allowed to dry on the wool, and if only it were thoroughly douched under a heavy jet of cold water all free lime would be removed without expense.

It is an unfortunate fact that many parcels of skin wool are offered for sale without any effort of this kind being made, and some wools actually reach the market containing no less than 8 per cent. of free lime. As each pound of lime will decompose no less than 15 pounds of neutral potash soap, this means that more than one pound of soap would be neutralized by every pound of wool that was put into the bowls. Even then the wool would not be washed, for the soap would be converted into a sticky and insoluble lime compound that would adhere to the outside of the fibers. It is true that there are many ways, all more or less expensive, by which the lime could be removed. For example, the limed wool might be steeped in acid prior to washing. But whatever may be said or done, this is clearly a case in which prevention is better than cure. It is scarcely stating the case too strongly to say that a fuller who thinks anything of the reputation of the trade is bound to see that no free lime is ever left in the wool.

All that has been said so far refers to lime which is present in forms which may be avoided by every fuller. But lime is a very insidious base indeed. It forms compounds with organic acids very readily, and it has a most extraordinary affinity for wool. If a pound of absolutely clean dry combed top be soaked in clear lime-water (which only contains one part of lime in 740 of water)the wool will rapidly absorb lime from the water until it has possessed itself of practically two per cent. of its own weight of lime. In what form this lime exists within the fiber is not quite clear. It can not be washed out with water

or alkaline solutions. It is probably in combination with the gelatinous or lubricating matter, to the great detriment of the nature and elasticity of the fiber, forming another compound which is injurious to the spinning and finishing properties of the wool.

It is clear that there is actual affinity between the material which composes the fiber and the lime—and that this affinity has far-reaching effects. It has already been shown that the free lime may be removed by water before the wool is ever dried, but lime which is in combination with the constituents of the wool is a much more insidious trouble. Benzine will dissolve and remove some of the combinations which it forms, but it will at the same time remove all the fats which lubricate the interior structure of the fiber. Their removal, of course, leaves the fiber harsher and less elastic, and therefore any one who wishes to be entirely rid of all of the lime from wool which has once been in a solution of that powerful alkali has only the choice of two evils—benzine or acid. So far as laboratory experiments can make anything certain, it can be demonstrated that hydrochloric acid will dissociate lime from organic compounds—extracting the lime as a soluble chloride and leaving the gelatinous matter and suint in very much their original position and condition. For this reason acids with all their drawbacks are better than benzine, for the latter dissolves the lime compounds as such, and therefore extracts from the wool much of its original substance.

The lime process when carried to excess has long been known as injurious to leather. It dissolves much of the gelatinous constituents of the hide, leaving the leather so poor and thin that no subsequent processes will restore it to its original condition. Stale limes also leave the surface of the hide unequal, because bacterial action is set up, attacking the membranous matter in the skin, with a result that has a distinct analogy to the effect of lime on wool. The lime process, therefore, stands condemned on two important grounds. Everything that is known of slipe wool coincides exactly with these statements. It has lost much of its elasticity doubtless through the removal or alteration in the character of the cementing material within the fiber, while its leanness in finished cloths is too well known to need further comment. It is always expensive to wash, and the impossibility of removing the lime compounds without the use of acids makes it entirely unsuitable for many kinds of dyeing and finishing.

(To be continued.)

KNITTING

DESIGNING FOR FANCY KNITTING ON THE CRANE SPRING NEEDLE CIRCULAR FRAME.

THEORY OF MAKING A DESIGN—ANALYSIS OF TWO FANCY DESIGNS OF KNITTED FABRICS.

(Contributed exclusively to COTTON.*)*

BY H. K.

Designs on knit fabrics produced on this type of machine are known as tuck presser work. In producing a plain knit fabric each presser wheel presses every needle beard as the needle cylinder revolves. Now supposing the presser wheel to be nicked on a milling machine on its pressing edge so that the nicks correspond to the needles and that each succeeding needle comes to each succeeding nick, the presser would still press each needle beard but the presser would make a certain number of revolutions to each revolution of the needle cylinder. For example take a cylinder with 840 needles and a presser with 120 teeth or nicks. The presser would revolve seven times to one revolution of the cylinder. Should every 20th tooth be filed deeper than the others, the result would be a tuck stitch on every 20th needle. If these needles were allowed to take a new loop without the previous tuck stitch being knocked off, they would become clogged up and break. By using a plain presser after the tuck presser this danger is obviated. This would give us a pattern of vertical stripes on every 20th needle.

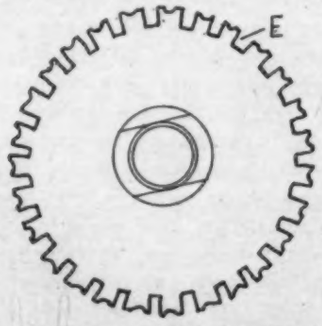


FIG. 1. DIAGRAM OF A 1x1 PRESSER.

Diagonal twills are made if the presser gains or loses one tooth at each revolution of the cylinder. In a nine-needle pattern using 108-toothed presser on a 1,000-needle cylinder, we find that nine divides into 1,000 with a remainder of 1. This will give a twill running to the left, and if the needles in the cylinder had been a multiple of nine less one, the twill would be to the right.

The simplest tuck presser is a 1x1 presser which has its pressing edge cut alternately one tooth and one space, each space and tooth being one needle wide. An illustration of the 1x1 presser is shown in Fig. 1. A simple design can be made by using two 1x1 pressers, using a black thread at one feed and a white thread at the other. The pressers are so set that the odd needles are pressed by one presser and the even needles by the second presser. The pattern produced will be single needle vertical stripes. Another pattern can be made with the same pressers but with a plain presser after each tuck presser. The plain presser feeds having the same color of thread and the tuck pressers another color.

When laying out a pattern, the tuck stitches should be divided as evenly as possible over all the needles in the pattern. If one needle tucks more than the others, the fabric when stretched will be liable to break into holes at the place where the greatest amount of tuck stitches is made.

When the pattern has been sketched on paper, the spaces marked represent the tuck stitches. The spaces vertically represent the needles and the spaces horizontally the

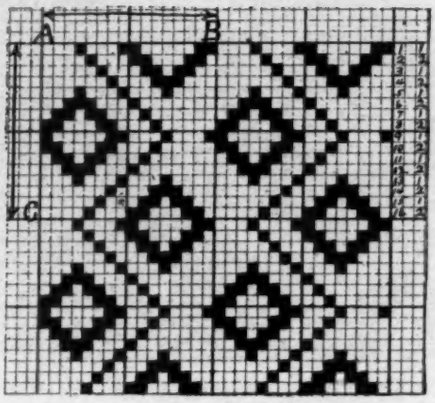


FIG. 2. DESIGN FOR A FANCY KNIT FABRIC, USING TWO PRESSERS.

courses in pattern. If two pressers are used, the horizontal spaces will be marked 1-2, 1-2 to the end of the design and this gives us the presser for each course.

Before we can start out to sketch a pattern there are three things which have to be considered: (1) The number of teeth in the presser; (2) the number of needles in cylinder; and (3) the number of tuck pressers. To ascertain size of presser and a given number of needles in the cylinder, we must find the highest common divisor for the teeth in the presser and needles in the cylinder. The highest common divisor equals the greatest number of needles in the pattern. Take for example a 128-toothed presser and a 1,040-needle cylinder. We find that the highest common divisor of these two numbers is 16, which therefore is the greatest number of needles you can use in the pattern.

The needles in the pattern divided into the teeth in the presser give the courses in the pattern. In this case, 16 divided into 128 equals 8, which therefore, equals the number of courses in the pattern. By using more than one tuck presser we increase the number of courses in the pattern correspondingly. The needles in the cylinder must always be a multiple of the teeth in the presser, leaving a remainder equal in number to the needles in the pattern or a multiple.

Fig. 2 is a design sketched out on a design paper and Fig. 3, is a sample of the knitted fabric. To show up the pattern, two contrasting colors such as black and white, black and red, black and yellow may be used or a single colored thread can be knit, and the tuck stitches will show up the pattern. The design Fig. 2, is made with four feeds using two plain pressers and two tuck pressers. Reading the design from A to B we find that the pattern repeats on the 17th space, so taht we have 16 needles in the pattern. From A reading downward to C we find it again repeats on the 17th space; therefore the design is 16 courses deep and the product of needles and courses (16x16) equals 256 stitches in the design. In order to produce this design on two tuck pressers, it follows that each presser must have 128 teeth each. Each alternate feed or course of loops is made with plain stitches. This is to allow the tuck stitches to be knocked off. The tuck stitches produce both plain and tuck stitches. When the deep cuts E in Fig. 1 come around to the needles, the needles which come to these cuts are not pressed but their loops are held until the succeeding plain presser knocks them off. These stitches show up as double-length loops in the fabric.

Each tuck presser is divided into sections corresponding

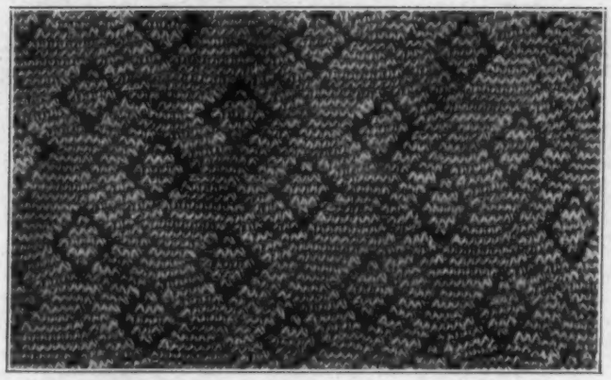


FIG. 3. SAMPLE OF KNIT FABRIC FROM DESIGN FIG. 2.

to the courses in the design. The design Fig. 2 is 16 needles wide so that each section must have 16 teeth. In a 128 presser we will have 8 sections. As already stated the teeth in the presser must be a multiple of the needles in the cylinder leaving a remainder equal to the needles in the pattern or a multiple of them. We find that a 128 tuck presser will revolve 8 times and 16 teeth past starting point to one revolution of a needle cylinder with 1,040 needles.

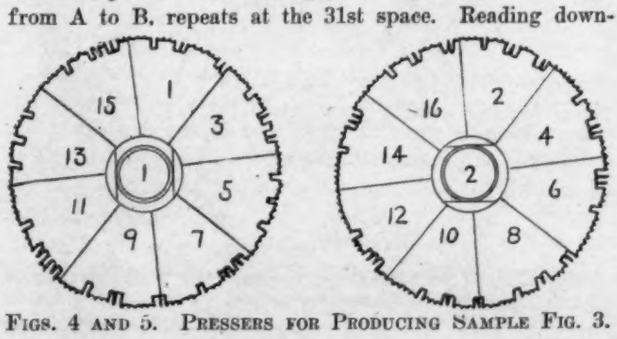
We then number the spaces in the design from A to C, 1 to 16; these spaces having been already marked 1, 2; 1, 2, etc., to correspond to the pressers on which these courses are cut. This gives the odd courses on No. 1 presser and the even courses on No. 2 presser. Figs. 4 and 5 illustrate how the sections are numbered and cut. The third course in the pattern must be cut on the section immediately following No. 1 section, and the fourth course on the section following No. 2, because at each revolution of the cylinder the pressers are 16 teeth ahead of their starting point. If the pressers were gaining any other multiple than 16 the sections in the presser would be numbered differently. It is important when setting the pressers to the needles that the first tooth of No. 1 presser and the first tooth of No. 2 presser start on the same needle, otherwise a mixture of tuck and plain stitches will result without any resemblance to the pattern being made.

Taking No. 1 presser shown by Fig. 4, and reading the first course in the pattern Fig. 2, we cut No. 1 section as follows; skip 3, cut 1, skip 3, cut 2, skip 5, cut 2.

Section No. 3; skip 5, cut 1, skip 3, cut 2, skip 1, cut 2, skip 2. The remaining odd sections are cut according to the pattern.

No. 2 presser shown in Fig. 5 would be cut as follows: Section No. 2; skip 4, cut 1, skip 3, cut 2, skip 3, cut 2, skip 1. Section 4; skip 6, cut 1, skip 3, cut 3, skip 3. The other sections would be cut according to the design.

Fig. 6 is a design for a fabric to be made by using five tuck pressers. The design, reading from left to right from A to B, repeats at the 31st space. Reading down-



FIGS. 4 AND 5. PRESSERS FOR PRODUCING SAMPLE FIG. 3.

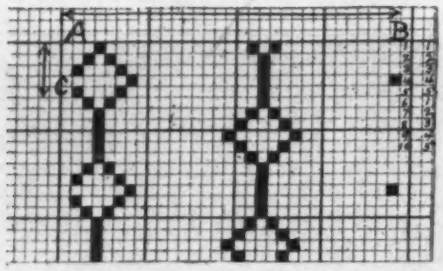
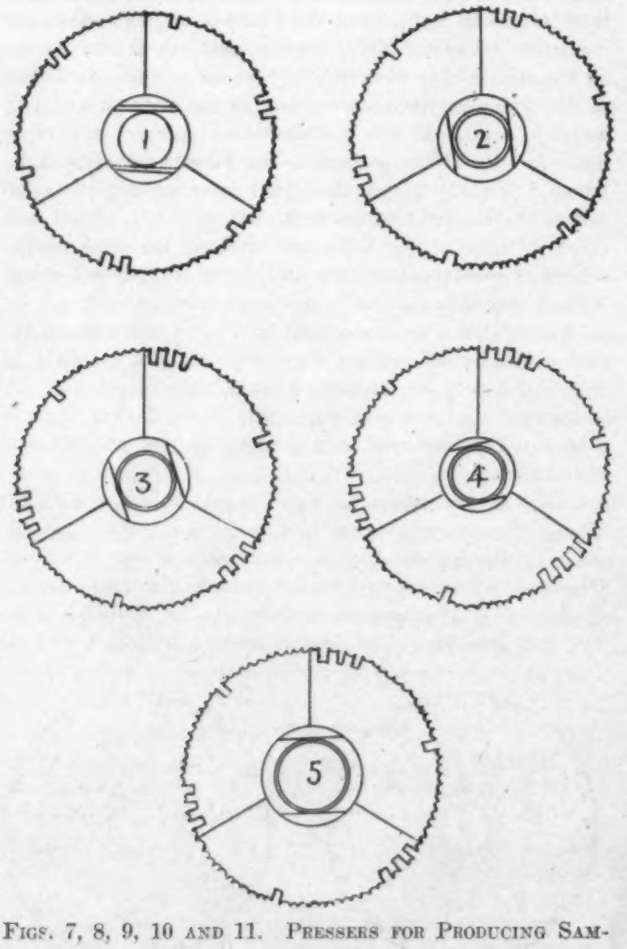


FIG. 6. DESIGN FOR A FANCY KNIT FABRIC USING FIVE PRESSERS.

wardly from A we find the pattern repeats at the 6th course, on the 16th space to the right; therefore, the number of teeth in the presser must divide into the needles in the cylinder leaving a remainder of 15. At each revolution of the cylinder the pressers will be 15 teeth past the starting point.

With five tuck pressers and only five courses in the pattern, we number the courses 1, 2, 3, 4 and 5. Each course is cut on its corresponding presser. Using 90-toothed pressers on a cylinder with 735 needles, we find that 90 divides into 735, leaving a remainder of 15. The pressers are divided into three sections of 30 teeth each, there being 30 needles in the complete pattern. Figs. 7, 8, 9, 10 and 11 indicate how the respective pressers are cut.

No. 1 presser will be cut as follows: Skip 3, cut 1, skip 13, cut 1, skip 1, cut 1, skip 10. Repeat on the two remaining sections.



FIGS. 7, 8, 9, 10 AND 11. PRESSERS FOR PRODUCING SAMPLE FIG. 12.

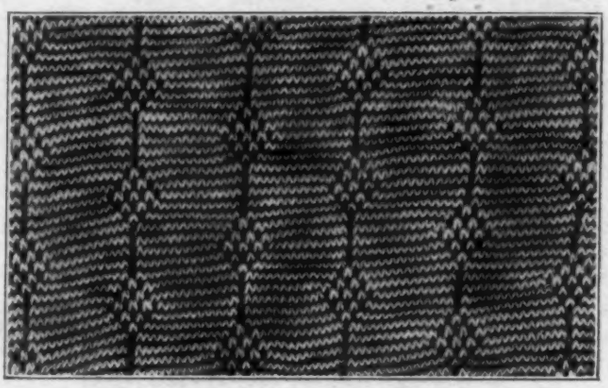


FIG. 12. KNITTED FABRIC PRODUCED FROM DESIGN FIG. 6.

No. 2 presser will be cut: Skip 2, cut 1, skip 1, cut 1, skip 13, cut 1, skip 11. Repeat twice.

No. 3 presser will be cut: Skip 1, cut 1, skip 1, cut 1, skip 1, cut 1, skip 12, cut 1, skip 11. Repeat twice.

No. 4 presser will be cut: Cut 1, skip 1, cut 1, skip 1, cut 1, skip 1, cut 1, skip 11, cut 1, skip 11. Repeat twice.

No. 5 presser will be cut: Skip 1, cut 1, skip 1, cut 1, skip 1, cut 1, skip 12, cut 1, skip 11.

Each presser requires to be set so that the starting point on each is on the same needle in the cylinder. Each course in the fabric should be exactly over the other.

The second course is knit by the same needles as the first course was, and the third above the second, and so on. The entire pattern is completed at every second revolution of the needle cylinder.

Fig. 12 is a sample of the knitted fabric. The toothed pressers can be secured from the manufacturers, and they can be nicked according to the gauge of the machine. It is advisable when ordering nicked pressers to state the number of needles in the cylinder and the diameter of cylinders. The deep cuts can either be filed or cut with a hack saw.

THE TOMPKINS TAKE-UP FOR SPRING NEEDLE KNITTING MACHINES.

THE TAKE-UP FEED. ADJUSTMENT OF THE TAKE-UP.

(*Contributed Exclusively to* COTTON.)

BY ERNEST TOMPKINS.

The take-up feed consists essentially of a crank which by means of a connecting rod reciprocates a dog meshing with a ratchet gear on a rough roller over which the cloth passes and is thereby drawn from the needles as it is knit. A view of the mechanism is shown in the accompanying illustration. A stationary or standing dog is used to hold the ratchet while the moving dog is on the back stroke. The crank throw and revolutions are designed to be greater than the maximum requirement, that is, the combination of coarsest gage, longest stitch and greatest number of feeds. Consequently a spring tension is used in the connecting rod or side rod to enable the tension of the cloth to restrict the motion of the roll to correspond to the rate of production of the cloth. If the machine is run with cloth on it, but with the sinkers and pressers out so that no new cloth is produced, the take-up crank throw will be expanded in compressing the spring in the side rod, merely maintaining a uniform tension on the cloth instead of continuing to roll it.

The ratchet is shielded from lint by a ratchet cover which also serves as a disengaging device for the dogs, so that the cloth may be slackened down. The ratchet cover is locked in position for engagement or disengagement of the dogs by a flat spring which presses a pin into one of two round holes in the cover. Raising the flat spring unlocks the cover. The cover should not be left between these positions since it may change unexpectedly to one or the other.

ADJUSTMENT OF THE TAKE-UP.

1.—Have no cloth on the needles, or have it slackened down. This is to allow of free turning of the ratchet roll.

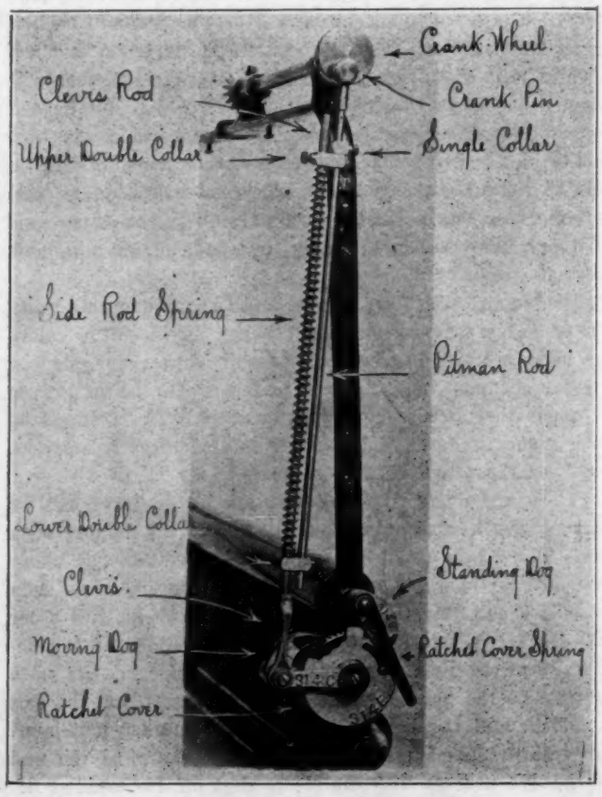
2.—Have the ratchet cover locked in the position for engagement of the dogs. This is to facilitate the adjustment of the moving dog, which should not strike the ratchet cover at either end of its stroke.

3.—Have the crank in line with the rod and the crank on the low side. This gives a starting point for adjusting the position of the dog.

4.—Have the spring and collars on the rods as shown in the illustration; that is, the single collar tightened on the pitman rod near the head. The upper double collar on both rods should be tightened on the clevis rod and up against the single collar. Lower the double collar on both of the rods holding the spring on the clevis rod and up against the upper double collar and tightened on the pitman rod.

5. Move the single collar down thus pushing the clevis rod and dog down until the nose of the dog is quite near the lower end of the space in the ratchet cover, but so that the dog does not strike the cover nor the clevis.

6.—Revolve the take-up, thus revolving the crank, until the latter is in line with the rod on the high side. If the nose of the dog does not strike the ratchet cover, then the adjustment of the two upper collars is correct. If the nose of the dog does strike the ratchet cover, then the dog has not been adjusted sufficiently near to the cover at the lower end of the stroke, in which case readjust with the crank on the low side, and test by turning again to the high side before running the machine by power, thus avoiding danger of buckling the rod if the dog should strike the cover.



VIEW OF THE TOMPKINS TAKE-UP.

Make the final spring tension adjustment after the cloth is stretched between the needles and the take-up. Give the machine a few turns by hand or power, at the same time noting the tension on the cloth by pressing the hand on the receding side.

7.—If the tension is wrong, move only the lower double collar up for more tension, or down for less tension. The old method of adjusting required an extra single collar, the adjustment was made from the top of the rod, necessitating climbing up on the table, or using a step ladder, and there was danger of the end of one of the rods becoming disconnected, or of the rods getting buckled owing to interference of the collars.

The new method eliminates one collar, and the others can not interfere, since the spring is between the fixed collar and the one used in adjusting the tension. The ends of the rods can not pull out, thus becoming disconnected, and the spring adjustment may be made without climbing.

EGYPTIAN COTTON.

Fully good fair Egyptian cotton from the lower Nile is selling at about 26¼ cents compared with 15⅝ cents at this time last year. This is 68 per cent. higher. Upper Nile cotton brings about 2½ cents less all round. That market, while conforming closely to price movements in America, is generally much less animated, and its contracts are more nearly the actual value of cotton than elsewhere. This year there has been wider buying than usual, because the Egyptian market followed rather than kept abreast of the American advance in the latter part of 1909. The yield for the current year is estimated at not above 1,100,000 bales.

How constant the production of this area has been, even under the improvement of later irrigation works, may be seen from the table below:

	Bales-Crop
1909	1,100,000
1908	1,350,000
1907	1,447,000
1906	1,390,000
1905	1,192,000
1904	1,262,000
1903	1,301,000
1902	1,167,000
1901	1,274,000
1900	1,087,000

Egypt has never grown quite 1,500,000 bales. In quantity it ranks with the State of Mississippi or Alabama. India this year grows precisely four times as much cotton as Egypt. The two together will contribute 5,500,000 bales to the world's crop, or little more than one-half as much as the United States.

Millions of yards of cotton cloth are used by the tobacco industry for growing tobacco under shade and making bags for smoking tobacco.

DYEING, BLEACHING AND FINISHING.

DYEING OF COTTON HOSIERY.*

BY DR. C. FISCHER.

The manufacturing of cotton hosiery is a very important branch, we might say the most important one, of the hosiery industry, and therefore we shall consider the dyeing of cotton hosiery in the first place. Good results in the dyehouse depend on a good many different circumstances. There is, first of all, the dyehouse itself, with the more or less efficient facilities. The dyehouse should be on the ground floor, should have plenty of room, plenty of light, good drainage and ventilation. There should be an abundance of water and good live steam. Machinery should be properly selected for the purpose it is intended for, and kept clean and in perfect running condition. Special attention should be paid to the condition of the water. Hard water will cause considerable trouble in the softening process by forming lime soap with the soap contained in the softener. The hardness of the water does not play as important a part in the dyeing of direct colors, sulphur colors, and aniline black, as it does in the softening process. Where the water is hard it should be corrected chemically in a softening plant, of which there are several types in existence.

In the softening plant calcium or lime salt and magnesium salts, both of which cause hardness of the water, are precipitated by adding milk of lime or lime water and a solution of soda ash in proper proportions to the water. The precipitate settles at the bottom of the apparatus, and the water, after having passed a filter, is kept in a large storage tank. As to the condition of the material to be dyed, there is no question that the same should be free from impurities—in other words, it should be clean. For light shades and fancy shades cleanliness is a primary requirement; if necessary, the goods should be scoured before they are dyed.

Oil spots are the cause of a good deal of trouble and of many complaints. They most generally originate in the knitting-room, and if the oiling of the knitting machines is not carried out in a careful manner the goods will become spotted and soiled with oil. There are so-called stainless oils on the market which, it is claimed, will not produce any spots, but unless they consist of oils of vegetable or animal origin, oils that can be easily saponified, they will not prevent spots. Machine oils composed of mineral oils will produce spots that can not be removed, spots that will always show up, especially on tans and blacks, except on aniline black.

The best and only way of avoiding oil spots is by practicing a little more care in oiling the knitting machines. Oil spots can also be caused in the softening process by using an imperfect emulsion of soap and oil. As a rule the goods are singed before dyeing in order to remove the nap or lint. In most cases, especially for direct colors, when the dyeing process is a comparatively short one, this is quite sufficient, and good results will be obtained as far as the finish is concerned.

The simplest way of dyeing hosiery is the dyeing in an open vat consisting of an oblong box with false bottom and the proper steam and water connections. The goods are worked by hand by means of poles. From 75 to 100 pounds of goods are dyed as a rule in these open vats. After the dyeing the goods are rinsed in the same tank, or, if a standing dyebath is used, taken out on a rack, allowed to drain off, and washed in another tub. It takes at least two men to run an open vat successfully. Although good results will be obtained with proper attention, as far as shade and evenness are concerned, machines will be found more economical, by saving time and labor.

TYPES OF DYEING MACHINES.

The principal styles of hosiery dyeing machines are of either the rotary or the paddle-wheel type. The rotary machines, as well as the paddle-wheel machines, have been in existence for a long time—the first one especially as washing and chroming machines, and the paddle-wheel machines for dyeing fancy shades. Of late both types of machines have been adapted for the dyeing of sulphur colors, especially sulphur black. They are built entirely of iron, and do not contain any brass or copper fixtures, which would be destroyed in a comparatively short time by sulphide soda. The rotary sulphur black dyeing machines have a capacity of 300 pounds of goods, while in the so-called paddle-wheel machines only 150 pounds of goods can be dyed successfully. I have not found any difference as far as efficiency of either one of these two types of dyeing machines is concerned. They both give very good results, in regard to both shade and evenness.

The vacuum machines have not found much favor so far with the hosiery dyers. There is no question, however, that sooner or later these machines will be perfected to such a degree that they will also be used for hosiery. A vacuum machine that will produce perfectly level dyeings, that will allow a perfectly thorough washing, that will not be the cause of marks or creases on plain or smooth goods, will be the ideal hosiery machine, as no other machine will be able to leave the goods in their original condition as well as a machine that keeps the goods always in the same position, and that does not tumble the goods about and have them all ruffled up.

In dyeing tans, blues, greys, and the innumerable number of fancy shades on cotton hosiery, direct cotton colors are used as a rule. These colors will answer the purpose for the cheaper line of goods, and even for better grades of goods they are used very extensively. The fastness of these colors to light and washing is moderate; it answers, however, the purpose in most cases.

They are dyed with the addition of common salt or Glauber's salt, with or without the use of sal soda or soda ash. The goods are first thoroughly boiled out for about half an hour in water only, or with the addition of sal soda or soda ash. After the machine has been filled with other water again, a solution of the dyestuff is added at 120 degrees Fahrenheit, the steam is turned on, and the bath brought to the boil in about half an hour. Then the salt is added, and the boiling kept up for another half-hour. Sometimes the goods are allowed to run toward the end of the dye process with the steam shut off for another fifteen minutes, in order to increase the depth of shade. After

*Read before the National Association of Hosiery and Underwear Manufacturers.

dyeing, the goods are rinsed in cold water, softened in the usual way, extracted, boarded, and dried.

The most important color for the hosiery manufacturer is black. Direct colors are not used for dyeing black, or perhaps in very few cases. Aniline black obtained from aniline oil or aniline salt by means of oxidizing agents is the black that held a predominating position for a good many years. When properly dyed, it is a beautiful intense black that no other color could approach for a long time. Its fastness to washing and light is remarkable. It takes, however, a considerable amount of skill, and accurate work is essential for the production of satisfactory results. Aniline salt, as white as possible, is the best material for dyeing a good aniline black. Some formulæ call for an addition of aniline oil in order to neutralize the acidity of the solution of aniline salt. It is absolutely necessary to prepare an aniline liquor that will keep a reasonable length of time—in other words, it is necessary to make the liquor in such a way as to prevent premature forming of aniline black.

It is best to use chlorate of soda as an oxidizing agent, on account of its great solubility. The solution of the same should be mixed with a solution of the aniline salt, and to this mixture a solution of sulphate of copper, as an oxygen carrier, should be added. All these ingredients should be dissolved in as little water as possible. In some cases aluminium acetate is added to the black liquor in order to avoid tendering of the goods in the ageing room. This neutralizes the hydrochloric acid formed in the oxidizing or ageing process. The formulæ for making aniline-black liquor, and the conditions of working, vary considerably in different works, and I refrain from giving any particular recipe in favor of others, as it would be impossible to discuss all the advantages and disadvantages of the different formulæ in so short a space of time.

After the goods have been saturated with the aniline-black liquor of about 12 degrees Twaddell in a tomtom, and hydro-extracted, they are put in the ageing or oxidizing room. Uniformity in temperature and humidity in every part of the room are of vital importance. Wet and dry thermometers should be used in order to regulate both the temperature and the moisture. In the dyeing and ageing process the color of the goods changes from a greyish-white into a light and finally into a dark green.

The temperature of the ager should be raised to about 94 degrees Fahrenheit, after the goods have been entered. When the goods are dry, the ageing proper begins. The steam is carefully turned on and allowed to enter the ageing rooms, as moist heat is required for the ageing process. The dry thermometer should register 94 degrees Fahrenheit, and the wet one 86 degrees Fahrenheit. The whole operation of drying and ageing takes about six to eight hours. The goods are then taken out of the oxidizing room and allowed to cool on the floor, or, better, on wire frames; finally, they are chromed and softened. It is advisable to use some sulphuric acid with the chromate of potash in the chroming process, as otherwise dyeings of a rather reddish shade would be produced.

The greening of aniline blacks, which was often the source of trouble, is caused by oxidation. The tendency of aniline black to crack or to rub off is only noticeable in dyed blacks, and not in oxidized or aged blacks. The bronziness of aniline black is said to be due to over-oxidation, and can be removed easily by some reducing agent. The tendering of the cotton fiber is the most serious of all faults of the aniline black. There is no question that free hydrochloric acid is formed in the ageing process, which tenders the cotton, on account of the formation of hydrocellulose. This trouble can be avoided by exercising the utmost care during the whole operation, and very satisfactory results will be obtained by using the proper precaution in making up the black liquor.

It is in the lisling process where the trouble begins, this process being nothing but a prolonged ageing. This is supposed to give the goods a good finish, as it takes off all the nap; but very often it is the finish of the goods too, because in the same proportion as the fiber of the nap is weakened, the fiber in the thread is attacked by free hydrochloric acid. The goods are actually carbonized in some instances and perfectly worthless. You can remove the nap without tendering or weakening your goods. This is a very serious objection to aniline black, or rather to the lisle-finished goods. If you don't want to lisle your goods in the ageing room you have to singe them, which is very often done in the green after the goods have left the ageing room.

On account of the difficulties in the dyeing of aniline black, and because of the many serious troubles and justified complaints, the hosiery manufacturers and dyers have looked for other colors to produce good results without incurring the danger of ruining the goods. The direct blacks are not fast enough to washing, and would not produce the full and intense shade of aniline black. Much better substitutes were found in the diazotizable blacks or developed blacks, and later on in the sulphur blacks. The dyeing of diazotizable blacks is rather complicated, but the final result is very satisfactory. These blacks are dyed like direct colors, with the addition of common salt or Glauber's salt. For the start it takes 6 to 7 per cent. dyestuff, and about 4 to 5 per cent. of color is used in the standing kettle. After the dyeing, the goods are rinsed in cold water and diazotized for about twenty minutes in a fresh cold bath, containing 3 per cent. nitric soda and 9 to 12 per cent. hydrochloric acid. The goods are then rinsed in cold water and developed with ¾ to 1 per cent. of meta-toluylene diamine, and about 1 to 1¼ per cent. of soda ash, for 20 to 25 minutes in a cold bath. When diazotized in copper vessels or apparatus with copper fittings, sulphuric acid should under all circumstances be employed, and never hydrocholric acid, as the presence of both copper and hydrochloric acid in the diazotizing bath frequently causes patchy or uneven dyeings. The process of diazotizing and developing changes the shade considerably, and the better brands of these blacks produce results of great beauty and depth of shade. The fastness to washing is extraordinarily increased by the diazotizing and developing process, and the dyeings are furthermore distinguished by their not altering their shade in storing. The strength of the fiber is not affected in any way, and the finest lace and fancy goods can be dyed with these colors without any risk. The goods may be either singed in the grey or after the developing; in the latter case they will have to be dried first in a so-called raw stock drying machine, then singed, softened, and finally boarded and dried again.

(To be continued.)

Practical Problems Discussed by Cotton's Readers.

Discussions of Mill Problems are Solicited for this Department.

FUEL ECONOMY.

BY D. R. S.

Under the present conditions of manufacturing when every little economy in running expenses and every slight increase in production makes a difference in dividends by no means insignificant, it is absolutely necessary to leave nothing undone that may increase power, production and economy.

The manufacturer who is able to reduce his power cost even a few cents per horsepower month is indeed fortunate, and the results of his labor soon show upon his books. Coal, being by far the most common fuel used in the production of power for cotton mills, is an expense to be watched continually, for waste here strikes at the very foundation of economical production.

In the operation of a steam plant there are several factors to be noted carefully, and continually watched for waste. These factors may be classified as follows:

1. The buying and handling of coal.
2. The combustion of fuel and generation of steam.
3. Power development from steam, cost and management of engineering labor.

Any one of these may be at fault, though each should be developed to a maximum of economy, and so correlated with the others that the whole system, as a unit, shows minimum losses. At the beginning of operation a capable, careful and efficient engineer should be employed. It is distinctly false economy to place an incompetent man in charge of any plant.

Tests should then be made at regular intervals of the coal used, and of boiler and engine efficiency. If it is shown that the plant when first installed develops one horsepower hour on five tons of coal, it should show the same efficiency with very slight decrease, month after month, and year after year. If it does not, something is wrong with the system and should be remedied at once.

There is room for much improvement in coal buying as practiced by the average manager. Not only should the price per ton be considered, but the chemical analysis of the coal as well, for this bears directly on the thermal efficiency of the plant. Perhaps you pay less per ton than your competitor, but it is probable that by paying more you could secure a coal containing so much less moisture and ash that it would be more economical than a cheaper grade.

Much depends also on the manner of stoking. Some men can generate a given quantity of steam with about half the coal that others would use. This must be looked after as well as that constant loss by boiler and pipe radiations.

Within recent years there has been developed a power far more economical than steam. No steam engine, not even a Corliss compound condensing, can develop the thermal efficiency of a properly proportioned and well erected gas engine producer plant. It is remarkable that so few cotton mill men realize the saving that could be effected by installing a gas engine electric drive in their mills.

Some of the advantages of such a plant may be noted as follows: The use of from 1 to 1½ pounds of coal per boiler horsepower hour, against the necessity of from 3 to 12 in a steam driven mill; less space and less labor are needed for the operation of the gas plant; economy of time in starting and smaller loss in handling coal. The first cost is very little more than that of a first-class steam plant of corresponding size.

As a comparison in fuel costs, take a mill using 5,000 tons of coal a year at $2.50 a ton. A good steam plant will probably require at the least estimate 3½ pounds of coal per horsepower per hour against one for the producer plant, or $12,500 for steam against $3,571 for gas. Thus the gas engine equipment would save $8,929 per year on a $12,500 coal bill.

After the producer plant and electric drive are in operation, a much closer regulation and easier inspection is possible than with a steam plant, and any waste is consequently more easily remedied. Obviously it is to the advantage of every manufacturer to consider carefully the coal and power question in all its various phases. Frequently it is advisable to employ a man whose sole duty is to devise an economical power system.

It is high time that this matter of fuel economy be more carefully looked after, and it is to the interest of every mill man to do all he can to bring about economical operation in his mill.

PREPARING FANCY SAMPLE WEAVES.

A. E. T.

During four months of the year from December to April, the mills making fancy cotton fabrics generally endeavor to make the greater part of the samples from which they intend to take orders for goods to be delivered the following season, the busy season being as a rule from May to January. After the samples are placed on the market, about May 1st, orders covering the entire season are taken, if possible, which enables the several departments to plan the work ahead to good advantage. The weave room overseer, working with the yarn departments, tries to arrange the different styles amongst his looms to the best advantage.

In distributing these styles many points have to be considered, among which may be mentioned (1) the length of time between the date of the order and the time the goods are to be delivered, and (2) how the different styles weave—easily or badly—as compared with each other.

A careful consideration of these items may mean a greater production, therefore cheap cloths and more satisfaction for all concerned.

First, regarding the question of delivering the goods, suppose a large order were received, requiring the goods to be delivered in 90 days. If the time given is sufficient, full warps should be made. Again, if the time given will allow two full warps to be run from each loom it might be advisable to twist one to the other after one had run out, using, say, two warps in each of 50 looms, covering a period of two months, rather than one warp in each of 100 looms and getting the style out in one month.

There is always more or less changing necessary on a loom when changing from one style to another, and this changing is avoided when the pattern of the new warp is similar to the one finished. In many cotton mills a boss weaver often finds towards the end of the season that he has cuts enough in the looms to fill the order, but has not enough looms working on that style to enable him to get it out on time, some of the warp beams containing a large number of cuts. This necessitates splitting the warps, that is, taking the larger warps out of the looms and re-winding part of the yarn from them on to other beams. This process causes extra expense in having to take warps out which have to be put in again, in having to re-draw three or more warps where one ought to have been enough, in the time wasetd by having the looms stopped while the warps are being taken out and put in and in other ways.

Second, the time to notice the way in which each style is likely to run is when the samples are being woven, for it is at this time that the price to be paid for weaving should be decided upon. If a style is sold that has been considered as one that a weaver could run readily on say five looms, and it is found after the order has been taken that three looms would be enough for one weaver, the price for weaving a cut has to be raised or the weaves will be unable to get off enough cloth to make a satisfactory pay.

Every weaver knows that a greater production is obtained on some styles, with the same number of picks per inch and speed of loom, than other styles, due to numerous causes, and instead of giving a weaver four or five looms of the same style, the custom is to put so-called "good jobs" on three or four of the looms and a harder pattern on the other loom in the set.

POINTS FOR SUPERINTENDENTS.

BY E. H.

The subject of managing help has been discussed and rightly so, because it is a hard proposition. It is certain that help is necessary to run a mill. The floating class of help gives more trouble to a mill than any other. This kind of help is changing from one place to another all the time, and when you do get a few days' work out of one, he will very likely cause you more trouble than all of your regular help. They try to kill all the time possible, and want to be favored and paid the highest wages in the room. I think that the overseers are to blame, to a certain extent, for allowing this kind of help to get into this habit. Some overseers favor and pet them as a means of holding them, but they soon get to where they are not satisfied at any place.

One thing that is needed among mill help generally is education, and there are very few mill managers and superintendents who make sufficient effort in that direction. They don't come in contact enough with the help outside of the mill to know their needs. They are also liable to conduct themselves in such a manner as to make the help feel uncomfortable when in their presence, which causes them to feel that they are drivers instead of leaders and instructors. Such a man will probably have the respect of the help as to his superior position, but they will not have any personal respect for him whatever. The trouble is they are not sufficiently acquainted with one another. I think that if superintendents, managers and overseers would take the lead and join in the social gatherings, church and Sunday School work, and everything that would be to the upbuilding of the morals and minds of the people, we would soon see a great improvement in the efficiency of the help in general.

Encourage them to be economical and to save something out of their wages. Encourage reading, look after the sick, and show the people by your actions that you are really interested in their welfare, and you will have efficient and contented help.

If a man is making ten dollars a day and another is making seventy-five cents per day and both are honest men one is as good as the other. The ten-dollar man can afford better clothes and without doubt has more education, but to come down to the principle of manhood and character, he is no better than the seventy-five-cent man. If the superintendent treats a man as an under-dog he will have sense enough to see how the superintendent feels toward him. While he may work for him, he will not do you as good work as he would if the superintendent had treated him as a man.

Another thing that I have noticed is that most mill managers are working more for quantity than quality or at least that is the result. They speed the picking and carding machinery to the highest notch possible, and rush the cotton through, without giving the machinery time to do the cleaning it is intended to do. And the result of this rush is that they get a sliver that is full of leaf and other foreign matter that will be detrimental to good running work through the whole process from there on to the weave room. A great many mills have their drafts too large on the slubbers, speeders, and spinning frames, and this makes uneven yarn and bad running work in the weaving department, and all kinds of kicks from the selling agents.

I will give my rule for finding the filling required to make a certain weight of cloth when you know what warp number you are going to use and the number of ends per inch and picks per inch and the width.

Take the total number of ends in the warp and add a certain per cent. for size and take up in weaving. The per cent. will vary for different weaves. Multiply this result by 16, the number of ounces in a pound, and then divide this by the number of warp yarn multiplied by 840. The result is the number of ounces of warp yarn in one yard of the cloth. Subtract this weight from the total weight of the cloth and the remainder is the number of ounces of filling in one yard of cloth. Next, find the yards of filling in one yard of cloth, by multiplying the required width of cloth in the reed by the number of picks per inch and multiplying this by 16. Then divide this result by the required ounces of filling multiplied by 840. The result will be practically the number filling required.

We will take for example, 36-inch, 56 x 60 — 4-yard cloth, using 21s warp yarn. We will have 2,040 ends in the warp and on this class of goods, we allow about 15 per cent. for size and take up.

$$\frac{2040 \times 1.15 \times 16}{21 \times 840} = 2.10 \text{ oz. wt. of warp in 1 yd. of cloth.}$$

4 oz. — 2.10 oz. = 1.90 oz. required filling wt. per yd. of cloth.

$$\frac{38.5 \times 60 \times 16}{1.90 \times 840} = 23.16\text{s}$$

Thus practically 23s filling is required.

WHAT A CARDER SHOULD KNOW.

C. P. T.

There is seldom too much stress put on the carding room and the necessity of having competent men there. The overseer in charge should be a man thoroughly qualified to fill the position, having complete and full knowledge of his different machines; knowing absolutely when they are producing the right kind of work. With this knowledge he should also be a man who will busy himself to see that his machines are performing their proper function. It is quite a different thing to know what should be done, and performing one's duty.

The most valuable asset an overseer can have is competent second hands and section men, who should possess a natural instinct to accord each employee respectful and courteous treatment. We are all human; both great and small, and if not accorded the proper respect our feelings are ruffled. No one is at his best when he thinks he is not getting fair treatment, and the foreman should at all times use as much diplomacy as possible in handling his help. Don't trifle with them, but be as plain as is possible to be; have no favorites; and accord each the same treatment. After each hand has had due consideration with proper courtesy, demand that they do their duty. If the help is allowed to go without proper discipline it is impossible to obtain results.

The mills are seeking men; offering many opportunities to the man who has the knowledge, and with this knowledge not only a will to do, but a determination to perform his duties well. There is hardly any business in this fair land of ours that offers better opportunities to the young men of moderate means. In other words the man or boy who has to earn his bread by the sweat of his brow can find no better opportunities than the mills offer today, provided the man or boy is willing to work.

To refer again to the card room, the cotton mixing should have proper attention, at all times getting the mixing as uniform as possible. This unfortunately is impossible with some mills at times, as the cotton is bought with little care and attention to its length of staple, and when mills are carrying small stocks of cotton on hand, the grades do not always have proper consideration. When there is a mixing of long and short staple, with low and better grades going in alternately, the mill cannot produce good yarn or good cloth.

The picker room machinery should be kept in good repair; well oiled; and well cleaned; drafts kept right; eveners kept right; aprons kept right; beaters kept right, etc. If this is done bad work will be at a minimum. All laps should run even, varying not more than one-quarter pound each way. This being the beginning of the work makes it the more important that it should be performed well. No care and attention should be spared to make it as perfect as possible in this department. If cards are fed with laps in proper condition, you have started with the proper foundation. The cards can not be expected to make good even sliver from poor uneven laps.

The card setting and grinding is quite important. Grinding should be light and frequent, but don't grind so heavy that the emery roll will spark fire when in operation, as this is injurious to the clothing. If the wire is once loosened in its foundation it will never do good work again and will have to be discarded for new clothing.

There is considerable study required on settings. When using .005 or .007 gauge two men will hardly make the same settings; one will set close or have the gauge tight, while the other will be the opposite. Then it is very often that we find cards of the same make and in the same room which require different settings in order to get the best results. It is quite important to use good judgment in handling the cards. If the picking and carding are good, there are two chances less to make poor work.

Drawing frames need equally as much attention, and right here I believe there is more damage done than on any other machines of like number and cost of operation. Usually there are a few boys to operate these frames, and the fixing is done by card grinders or speeder fixers and they don't attach much importance to it, since it will run after a fashion with very little attention. The drawing rolls should be properly set, giving the spread that is suitable to the cotton used; trumpets kept one size; rolls kept clean; and see that the sliver comes through without too great tension between front roll and calender roll. This point is very important, as more uneven yarn will result from stretched drawing than almost any other cause in the carding department. A good way to determine whether your drawing is going through without stretch or not, is to lift the sliver with a pencil, and if there is not too much tension it will pick up slowly; if to the contrary it picks up quickly with a jerk. In the latter case there is a change needed to be made immediately.

The tension needs equally careful attention on slubbers, intermediate and speeders. If this is kept right and the rolls given the proper spread, there is little chance to make poor work on these machines, taking for granted, of course, that we have good work on the preceding machines.

COURTESY IN THE MILL.

J. J. B.

The management of help seems to be to be the chief thing connected with cotton mill work. I have been an overseer of spinning for a number of years, and experience has taught me that. The fact is, I worked from doffer boy to my present position.

An overseer should be a level headed man. He should have the spirit of the work in him, and push forward daily, complaining to no one. He should be a man of untiring energy, so that his followers will never detect any discouragement even when he feels most troubled.

I have seen men who thought it discreditable to their title to sacrifice their newspaper and revolving chair for an hour at the time. I say without hesitation that in these days of close competition and small profit, those men have changed their attitude or have been reduced to a minor position.

An overseer should be the leader, ready and willing at all times to show any of his help how to overcome the smallest difficulties, and take pains to explain how to avoid future trouble. This should apply to the second hand and on down to the sweeper. A good system is the life of a plant. In managing children their work should be carefully assigned to them. The overseer should stay in close

touch with them, seeing that they carry their work on without any serious difficulties. Never allow a hand to have such easy work that he will have nothing more to do than to go from one operative to another putting mischief into their heads. Let none fall short of what he is paid to do, but give them a reasonable amount of work to perform. They may be sometimes so over-burdened and become so discouraged that they had rather go home than have the job, and this is especially so with children.

After relating the case to their parents, ofttimes adding something more, they are generally sustained by them. The parents keep the child out of the mill until they see the superintendent, or they often move without investigating the case, which is an injustice to the overseer.

Some overseers say they have their second hands trained to be just as trustworthy as themselves. They may be in some cases, but I contend that they have not the proper foresight.

I have found it a very good policy to advise second hands and section men every few days as to how to manage, as they ofttimes get worried and forget orders. Stay in constant touch with them and see that every order is executed. The overseer who sits in his office with his feet thrown up on his desk or standing around with folded arms talking of some lazy hand in his room is not the successful man. He has to be the kind of a man to make that lazy hand a good one, without losing him or other members of his family. I know there are some who look as if they were good for nothing, but every one has a gift for some kind of work, and that is what the high salaried man is paid to find out.

There is no fixed rule for managing such help. It is for the man who is in closest touch with the individual to decide what means to take to subdue the unruly one. Fifteen years ago the overseer wouldn't bother his head studying the nature of different hands; he would end the matter by discharging them.

All mill men are endowed with some strong point on mill work. Let us get all the good ideas from one another that we can, and push forward with them, and our work will be easier. Keep pace with the times. That is one of the hardest things to do, but your reward will be proportionately large.

THE GREAT PROBLEM IN THE COTTON MILL.

J. H. Y.

We shall not attempt to discuss the different machines of the mills in this article, as there is such a vast difference in the ideas of superintendents and overseers in the mill business, on drafting and twisting and the speed of the machines, that it is almost impossible for the overseers of different States to advise others how to get the best results from the same grade of cotton. This is because the climate varies so much in different localities, and the machines have to be governed by the weather more or less. Then, again, some mills use humidifiers, where others do not. All of these things affect the yarn, but the writer has an idea that if the mill overseers would discuss the problem that confronts us daily, we would be benefited more or less, and that is, how to get the best possible results from your help with the very least cost.

The writer is of the opinion that it is not altogether the labor question that prevents some mills from competing with others. There are several reasons for this, one of the greatest is that some mills are required to run very low grades of cotton, while others use good middling. We must all admit that a mill that uses a low grade cotton can not compete with the others using a better grade. The per cent. of waste in the low grade will be higher and the production will necessarily be lower, so that we can see at a glance, that a mill run on this basis will not compete with any others, even with the very best kind of help. This is especially true this year, as the low grade cotton is being doctored with water and sand so much that one-fifth of it is a loss at the very beginning.

Every mill operative can not make an overseer, for it takes a steady head to make a successful overseer. There are a great many men having charge of rooms who are not qualified to be oilers. They lack judgment, and care for nothing except a fat pay ticket. A man does not need to be a preacher or a desperado to run a room in a mill. He must be a steady, straightforward, business-like man with a thorough knowledge of the work in all of its details, that he may be able to remedy all things that are wrong, and at all times, use "The Golden Rule" that is "As ye would that men should do to you, do ye even so to them." Always be pleasant with your help, as it is much nicer to be polite than abrupt.

If you go through your room and see someone who is worried over his work, do not swear and curse at him, as that will not help the matter at all, but will cause him to have a contempt for you. If possible, lend him a helping hand and encourage him with kind words, for he has feelings the same as you, that can be hurt. Mill people of this generation have learned to be led rather than driven. I fail to see where it ever benefited a cotton mill company to fore its operatives to work a notice before leaving. If an operative gets dissatisfied and wishes to leave, the best plan is to pay him and let him go, for if you force him to stay against his wishes, nine times out of ten, he will not do the right thing by the work, and in many cases gets other hands dissatisfied, before the notice is worked out, especially if he is going to some other mill.

If there is a hand in your room, that is not working satisfactory, do not send your fixer or second hand to curse or abuse him, but go yourself, or send for him to come to your office. Talk to him kindly, that he may know that you are his friend. Explain the work to him, showing him the easiest way to do it. Teach your people what is required of them, for that is the work for which you are hired.

Everyone likes to be complimented sometimes, especially by the overseer. If the foreman would practice a little kindness he would hold the help much better than he does as a rule. I have a profound contempt for a little two by four overseer, who will strut through his room with a pencil stuck in his upper vest pocket, looking as wise as an owl, talking of what he can do, yet never accomplishing anything, and cursing the poor little doffers and sweepers.

You should always be kind and courteous to your help when you meet them on the street. Thus you win their respect and love, and the news will go out that you are a good man to work for. You will then have no trouble in keeping plenty of good help all the time.

NEW MACHINERY AND TRADE NOTES.

THE CARE OF COTTON BELTING.

Driving belts are made from animal, vegetable or composite material that in itself is subject to rather rapid deterioration. This condition makes belting short lived in comparison with other parts of the power plant. Deterioration within a belt is also hastened by the continually changing tensile stresses, the wrenching and bending of the fibers, the pounding of the belt against the pulley at every contact, and the surrounding moisture, dirt, oil and other harmful elements to which the belt may be exposed.

Cotton belting is no exception and must, if anything, be more thoroughly protected than leather to remain in good condition through a long life. This applies to all cotton belting, whether woven, or canvas folded and stitched, and whether filled or unfilled. The filled belt, commonly known as "painted canvas" belting, is by far the more common. This form is filled with some preparation to prevent stretching, and to waterproof it, and is covered on the outside with one or two coats of red paint, thus forming, while new, a good and comparatively cheap belt for rough hard work. When run with proper slack, this kind of a belt gives splendid service for a while without attention, the length of time depending upon the character of the work, the load, the amount of slipping and the exposure. The painted canvas belt is fairly waterproof when new, because the paint on the outside and the gum in the filler naturally keep the water out. But after a painted belt has been in use for some time, the paint wears or chips off of the belt surface, leaving the pores more or less exposed.

If no protective measures are taken the gum in the fibers gradually hardens and the belt becomes stiff. At this stage cracks appear upon the back of the belt, working in from the edges. As the belt cracks in this way, the fibers are likely to break as well as become exposed to moisture. These conditions need not be serious if given proper attention, but if neglected they are bound to make trouble.

Water cannot get out as easily as it can get into the minute cracks, and if its entrance is permitted at all the fabric sooner or later rots. The original preservative and waterproofing materials begin to fail from age, and when they do so they must be replaced or the belt cannot long withstand the strains of service and exposure to decaying influences. Something must be applied which will penetrate through the cracks and openings of the paint and get down into and among the fibers of the cotton to soften the gum and fabric and keep the belt pliable. This substance to be effective must also waterproof the belt and keep its surface in condition to prevent slip.

FIG. 1.—A REHABILITATED CANVAS BELT, AFTER TREATMENT WITH A PRESERVATIVE.

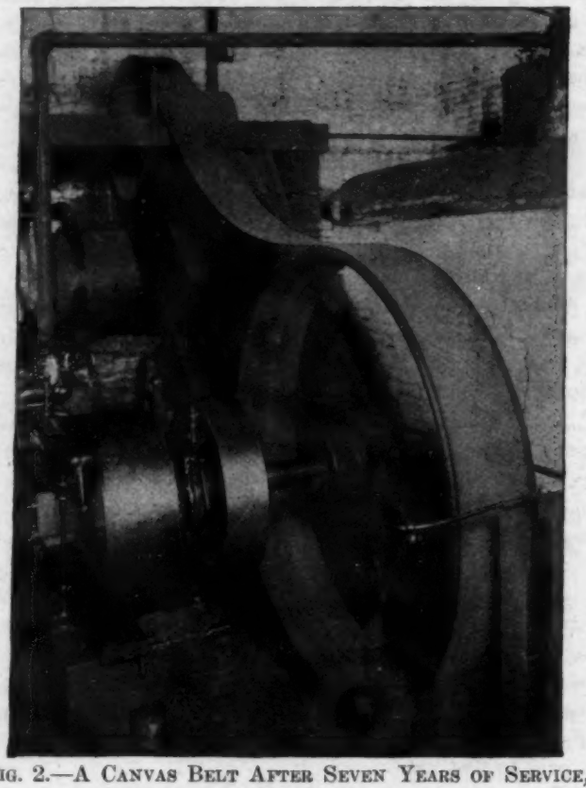


FIG. 2.—A CANVAS BELT AFTER SEVEN YEARS OF SERVICE, PRESERVED BY PROPER TREATMENT.

Where a belt is kept in prime condition it continues to transmit full load without the necessity of tightening to prevent slip. This in itself effects a big saving in decreased attention, less trouble from hot boxes, worn bearings and a minimized internal friction load. The possibilities of careful treatment of a painted cotton belt are well shown in the accompanying illustration Fig. 1, showing a 10-inch heavy canvas belt at the plant of the Richford (Vt.) Mfg. Co. The 14-inch pulley on the motor runs at 850 R. P. M. and delivers to a 40-inch pulley on the shaft. The belt was an old one which had frequently been designated as no good, and was put into service only as a makeshift. At first this belt would not carry the friction load, and was treated with Cling-Surface, a preservative preparation for belting and ropes, made by the Cling-Surface Co., Buffalo, N. Y. This belt now transmits 85 H. P. without slip, although the sag is 23 inches from the direct line of the pulleys.

Another typical example is that of a 12-inch canvas belt illustrated in Fig. 2. This belt has been working for seven years in a plant in Marion, Ind., and has been treated with Cling-Surface throughout that time. It runs from a 72-inch driver (200 R. P. M. to a 42-inch driven pulley on 11 foot centers, and delivers 50 H. P. Although the sag is 17 inches

under greatest load, there is no slip. The belt is always clean and pliable and requires no attention other than an occasional application of the preservative.

Plain canvas belts are used mostly in uniformly dry places because in their natural state they are easily influenced by atmospheric conditions. If not given special treatment they act something like a clothes line—tight on damp days and loose on dry days. If left unfilled, a woven canvas belt—and most of them are woven—is apt to stretch a great deal, and in doing so is reduced in thickness and width. There is a considerable advantage in treating these belts with a preservative waterproofing composition in that the inner fibers mat down closer without the surface cracking, and by increasing the density, firmness, and weight of the belt prevent the stretch to a considerable degree. A belt of this kind once saturated with waterproofiing compound is impervious to moisture and should give better service than a rubber belt in places where climatic conditions or running water are otherwise troublesome. In such service the treated canvas belt often proves less expensive in the long run than the rubber belt.

LIGHT IN TEXTILE MILLS.

With the low prices which are now paid for textiles, any saving, no matter how slight, which may enter into the cost of the finished product of a textile mill becomes a matter of vital importance, and the aim of the up-to-date manager of the modern mill is to cheapen the cost of manufacture in every possible way, without affecting the qualities of the materials turned out.

In the weaving of fine yarns, and in fact of all textile fabrics, it has always been a recognized principle that better work and more work can be done where there is the greatest amount of light, for this enables the operators to give more careful attention to the machinery, and so improves quality. It is also recognized that for both spinning and weaving, daylight is far superior as a method of illumination to artificial light. It is because of the universal recognition of this principle that the walls and ceilings of spinning rooms are invariably covered with a white paint of some kind, so that the outside light may be caught and reflected as much as possible, for the operators' use.

A number of years ago there was placed on the market a material known as "Sta-White," which today is being very successfully and satisfactorily used by many of the leading textile mills both in the South and in the New England States for the interior painting of operating rooms. "Sta-White" is a high-gloss white paint, which, for light reflecting purposes is said to go far beyond a white-wash or an interior white lead paint, which for many years was in common use. Made as it is of special materials, it possesses very high light-reflecting powers, catching every bit of sunlight and distributing it equally and softly throughout the room.

By actual tests in comparison with ceilinsg coated with white-wash and with white lead paint, "Sta-White" has been shown to not only increase the light in a room materially, thus enabling the operators to do more and better work, but also it was proved that the use of "Sta-White" enabled work to be continued by laylight for a considerably longer period than in the rooms painted with white-wash or white lead paint, thus making a material saving in the illuminating expense of the mill.

The use of white-wash as an interior coating has been found to have many draw-backs, among these being that

CARD ROOM OF THE ADELAIDE MILLS, ANNISTON, ALA., PAINTED WITH "STA-WHITE."

when thoroughly dry, the jarring of the machinery tends to cause it to flake and fall from the walls, oftentimes getting into the machinery and hindering the work, and frequently doing considerable damage. Both white-wash and a white lead paint are said to have another disadvantage, in that when they are touched by dirt or grease they immediately become discolored, and can not be cleaned, so that a frequently otherwise clean and modern mill will be conspicuous because of its blackened and untidy walls, which must remain in this condition until they are repainted.

"Sta-White," on the other hand, because of the extreme hardness and smoothness with which it dries, and the lack of absorption in the materials from which it is made, may, when soiled, be cleaned to its original whiteness by the simple operation of applying pure water, and after cleaning will return to its original color and gloss. As it can hold no dirt it is therefore highly sanitary.

It has been shown from actual experience that "Sta-White" will give service for a number of years, and therefore when the labor of applying the paint is taken into account it would seem to be more economical than a white-wash which required constant renewal, and because of this saving, and its many other advantages, the use of "Sta-White" is becoming general for new mills, and for the repainting of many present ones.

"Sta-White" is made by the Detroit Graphite Co., Detroit, Mich., and either they or their office at 903 English-American Building, Atlanta, will be pleased to furnish information upon request.

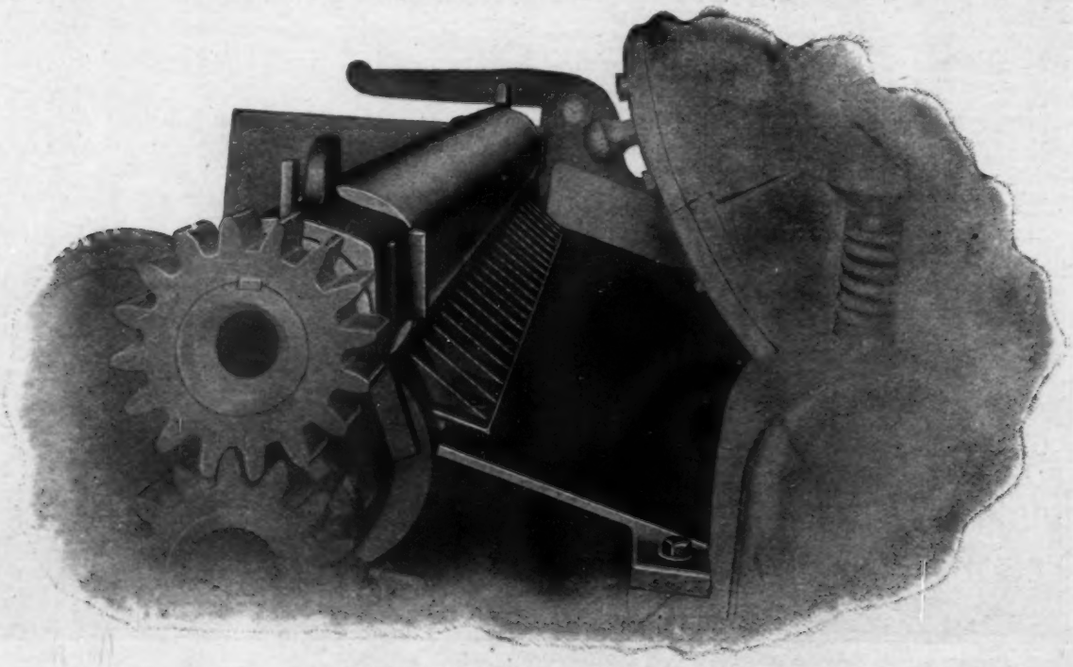
KITSON'S SPLIT LAP PREVENTER.

This arrangement as shown in the accompanying illustration is a new patented device for the prevention of making split laps on the pickers. It consists of a row of pointed teeth extending well into the bite of the calender rolls, so that the lap in passing over the points receives a crease in the direction of its length from each point. These creases act as binders and keep the lap from licking up or running in double on the card. All of the pickers now built by the Kitson Machine Shop, Lowell, Mass., are fitted with split lap preventers to insure the laps running off smoothly on the intermediate and finisher aprons. Although there have been several devices for preventing split laps, some of which are good, some bad, the makers claim that this attachment is the cheapest, simplest and most effective device for producing a non-splitting lap for cards from the finisher lapper.

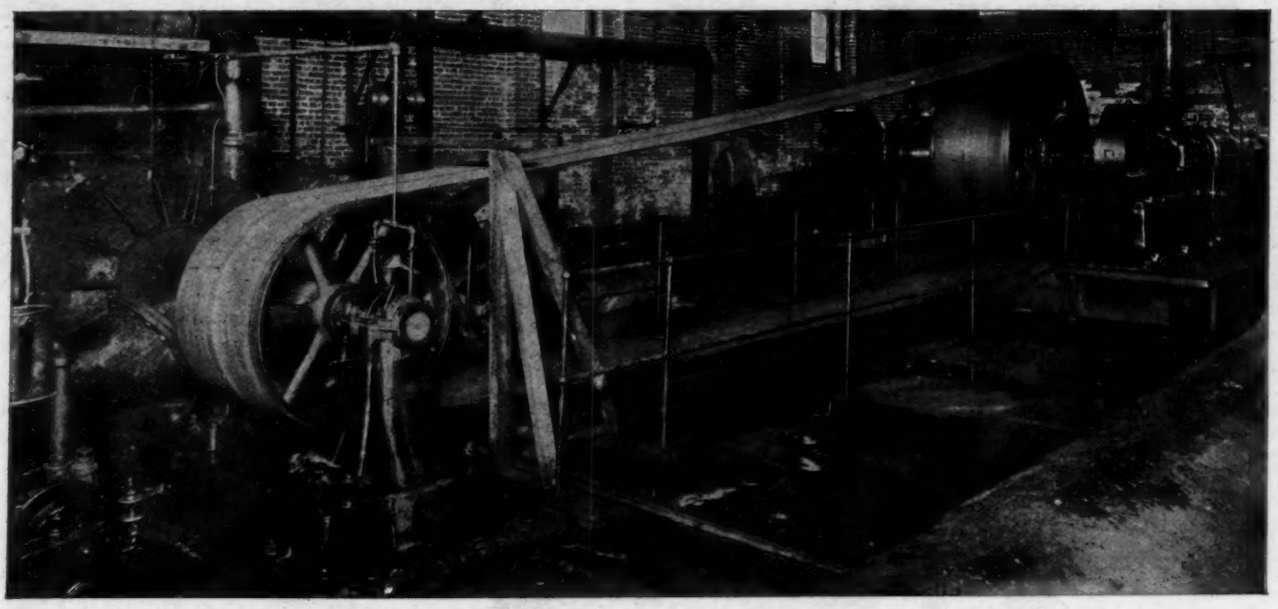
THE ADVANTAGES OF LAMINATED CONSTRUCTION IN LEATHER BELTING.

Economy in transmitting power by belted drives depends, first of all, upon flexibility of the belting and the smoothness of its surface. If the belt is stiff and hard either internally or on the contact surface, it can not be expected to wrap around the pulley as closely as it must to prevent slipping. Surface smoothness in a multi-lap belt is dependent upon placing the grain or hair side of the leather to the outside, and in an ordinary single belt by placing this next to the pulley. Yet the grain surface is the weaker part of the leather, being the first to be injured by improper tanning, the first that will burn from slippage of a belt on its pulleys, and the part that is likely to be ripped off in patches by sticky belt dressing.

The steady pounding which this surface naturally receives with every pulley contact tends to make it hard and brittle until, as the amount of slip increases, the outside leather burns and leaves the interior of the belt open to gradual deterioration. The fibers of leather are mostly parallel to the surface, and when brought into sidewise contact with the pulley as they must be in ordinary belting, the effect might well be compared to that of daily traffic on wood paving blocks laid with grain parallel to the street. In the latter instance, the wood would splinter to destruction in a very short time; but when placed to receive the blows against the ends of the fibers, the continual pounding does practically no damage. Similarly, a butcher's block with the grain parallel to the top would be ruined in a hurry. The fibers in belting are affected or rather unaffected in much the same way when the pressure comes



KITSON'S SPLIT LAP PREVENTER.



A LAMINATED BELT INSTALLATION.

end-on. This is precisely the condition which is brought about in a laminated belting. The leather strips or laminations, all of equal cross section, are bound side by side without cement and so placed that the cut edge of the leather forms the belt surface. The leather is not only longer lived and more flexible when so placed, but by reason of the fibers being better able to retain their natural dense interwoven position, they seat themselves more firmly against the pulley surface, cling better and permit the belt to transmit a far greater percentage of the power.

The advantages of bringing the cut edge of the leather into contact with the pulley as compared to using it in the ordinary way are strikingly shown by an experience of the Standard Oil Co. with one of the belts in their Eagle Plant at Jersey City, N. J. In this plant, which is their largest refinery of lubricating oils, the condenser water is circulated by a 16,000,000-gallon centrifugal pump which in turn is belt driven from a 500-horse-power Fleming-Harrisburg engine. The driving pulley is 90 inches in diameter, the driven 42 inches and the distance between centers is 28 feet, 2 inches. As first installed, a 32-inch, 3-ply ordinary leather belt strengthened by a 24-inch, 3-ply rider was employed to drive the pump. In justice to this outfit, it must be stated that the varying temperatures and moisture in the plant are very severe on flat-lapped belting. Trouble was experienced with the belting almost from the beginning, and as the stretching of the leather continued, the belt slip increased until by actual test the power loss was over 20 per cent. The driven pulley face overheated to such an extent that shut downs were necessary at various times during the day. Belt dressings were tried but offered nothing more than a temporary relief. So much dressing was used that on hot days it would ooze out of the belt and cause an all-day shut down, during which the auxiliary pumps had to be used. To make matters worse, the plies of both belts parted, due probably to the surrounding moisture, and the belts had to be sent back to their manufacturer for regluing. There had been no stinting of price in buying these belts. On the contrary, every effort had been made to get the best, and when the trouble had reached the stages mentioned, the Standard Oil Co. was about decided that the only remedy was to remove the entire installation and replace it with a direct-connected outfit.

As a last resort before doing this, it was proposed to try laminated belting, and the drive was equipped with an Albeco laminated belt made by the American Laminated Belting Co., of New York. This drive is shown in the illustration. The belt is 28 inches wide, and equivalent in thickness to a three-ply lapped belt. The results are of more than passing interest. The power loss now from belt slip is hardly perceptible. The pump when driven by the old belts would lose its suction if the steam pressure fell below 85 pounds, while with the Albeco laminated belt the pump can be operated with as low as 65 pounds of steam. The laminated belt has never been taken up nor has it required other attention. It is doing with 21 square inches cross-section of leather what could not be done by 6 plies of the best leather of about 39 square inches cross-section. The laminated belt has never deviated more than one-fourth inch from its true position on the pulleys and its even motion has been the source of much comment. The stout guard of two-inch by four-inch timbers shown near the pump in the illustration had to be used with the lapped belts to keep them from going over the side of the driven pulley when full load was thrown on, and at other times as well. The guard on the far side was faced with leather three inches deep, but in the natural course of running the edge of the lapped belt cut through this clear down to the wood in several months time. The guard was left in place when the laminated belt was installed, thinking it might be needed, but so far it has had nothing to do.

CHAS. T. MAIN, Engineer, Boston, Mass., announces that he has moved into more commodious offices, Rooms 817-833 of the New Boston Safe Deposit and Trust Co. building, where he will be better prepared to conduct work in the following branches of textile engineering: textile mills and other industrial plants, water power and steam power development, examination and reports on plants with reference to their value, reorganization or development.

NEW AMERICAN STEEL PULLEYS.

Twelve years ago when an American inventor planned the first steel pulley, he little thought that his idea would revolutionize a trade, create a new standard, and his invention find its way to every civilized country on the globe. It was in reality the great oak arising from the little acorn, so typical in American business life. There seems to be ample reason for "American" steel pulleys being so well liked, and preferred to those made of cast iron or wood. They are 45 per cent. lighter than cast iron pulleys of the same size, are invariably safe at high speeds, and there is never any danger of their bursting destructively. They are also made on clean and compact lines, which get the best results possible. The many users of this excellent specialty, as well as the trade in general, will hear with interest that the makers have added to their line a range of new diameters from 50

AMERICAN STEEL PULLEY.

to 60 inches inclusive. These new sizes embody all the leading points of mechanical excellence, which have made the lesser diameters so well liked, with the exception that for strengthening purposes the larger diameters have eight arms instead of the usual six.

When it is considered that over 200,000 pulleys of different sizes are turned out annually by The American Pulley Co., at Philadelphia, Pa., the rapid growth of the demand can easily be accounted for. A particularly gratifying feature of their business expansion is the steady conquest of the various foreign markets, as evidenced by recent heavy orders from such countries as India, Egypt, Australia and the Philippines. There is now ready a new general catalog which will be sent gratis to all inquirers, and the manufacturers particularly solicit inquiry correspondence, which always receives sharp attention in a special department for the purpose.

THE U. S. RING TRAVELER CO. was established in Providence, R. I., in September, 1909, with Wm. M. P. Bowen, president, and Amos M. Bowen, treasurer. After seventeen years' experience, embracing every branch of the traveler business, Amos M. Bowen has fitted the factory at 92 Westfield Street with machines of his own design and built by his own workmen. Combining many improvements as the result of long experience, the product of these machines, finished to a degree of perfection which they claim is not equaled, is offered to spinners and twisters with every confidence that it will give satisfaction. Where speed travelers are required or in cases where conditions may be improved, Mr. Bowen offers his personal suggestion and assistance. Sample orders will receive intelligent and prompt attention. With a business in excess of their expectations in these first months they are grateful for the favors of their friends and customers. Wm. M. P. Bowen is a member of the Rhode Island senate from the Providence district.

S. A. FELTON & SON CO., Manchester, N. H. manufacture the well-known "Safco" mill brushes. This name was incorrectly printed in the last month's issue. This trade name is derived from the name of the company.

DRAPER CO., Hopedale, Mass., in its June issue of "Cotton Chats" gives a brief discussion of the timely subject of "Curtailment in Cotton Manufacturing," in which is mentioned the fact that the mills have taken advantage of this time to replace their common looms with new Northrop looms. Four illustrations of different types of Northrop looms are shown, namely, Northrop Side Cam Pillow Tubing Loom, Northrop Dobby Loom, Northrop Worsted Loom for fine dress goods, and Northrop Side Cam Corduroy Loom. Illustrations of the Northrop loom bobbins and shuttle are shown on the last page.

THE OTIS ELEVATOR CO., New York City, in its June number of "The Indicator" gives an illustrated description of the Blackstone Hotel of Chicago as its leading article. Among the other articles of interest are "The New Quincy Plant," "Address of President Baldwin," "What Constitutes a Good Business Man," "Hydraulic Elevators," and others.

CASSELLA COLOR CO., New York City, in its June issue of "Dyestuffs," publishes articles on "Artificial Silk—Its Origin, Properties and Processes of Dyeing," and "Preparation, Dyeing and Finishing of Ladies' Cloth." Dyers and finishers may obtain this bulletin monthly by addressing the home office of the company.

PETTINGELL-ANDREWS CO., Boston, Mass., in their July issue of "Juice" describe a very interesting conversation under the heading of "From the Central Station's Point of View." Under the heading of "Pioneers of Electricity," Sir Humphrey Davy forms the subject for the sixth article in this series. "Economy in Construction Material," is discussed briefly. Among products described are The Universal Switch Boxes, A-B Flaming Arc Lamps, Perkin's Electric Switch, Stapher Guy Clamp, and others.

J. B. COMSTOCK, for six years with the Westinghouse Electric & Manufacturing Co., at its East Pittsburg Works, and for four years manager of its publication department and printing plant, severed his connections with that company recently to accept a similar position with the P. & F. Corbin Co., New Britain, Conn. Prior to Mr. Comstock's connection with the Westinghouse Company, he filled the same position with the Corbin Co. that he has recently been recalled to assume.

SZEPESI & FARR, New York City, is the form of copartnership which will hereafter conduct the textile machinery business formerly handled by Schuchardt & Schutte. The address of the concern is 90 West Street, New York, where the foreign machines, formerly sold by Schuchardt & Schutte, as well as several domestic textile accounts, will be handled. The firm consists of Eugene Szepesi, formerly in charge of the textile department of Schuchardt & Schutte, and Arthur V. Farr, mechanical engineer, formerly instructor in engineering subjects at Stevens Institute of Technology. Mr. Szepesi is in Europe and will bring back some of the latest developments in the textile machine industry.